Electrical World

The consolidation of Electrical World and Engineer and American Electrician

Published by McGraw Publishing Company, Inc.

Vol. 61 NEW YORK, SATURDAY, MARCH 15, 1913 No. 11

Indiana Public Utilities Law

The State of Indiana has just adopted a public utilities law, abstracted elsewhere, which is a model of its kind and ranks with the Wisconsin act as one of the fairest and most effective instruments of regulation on record. The pitfalls into which legislators in some other states were led have been avoided, and the decks are clear for state-wide administration of the new act under conditions which hold forth the promise of a square deal for all and favoritism for none. The Wisconsin plan of indeterminate permits in lieu of franchises having a definite term has been adopted outright, and to every public utility company a strong inducement is held out to relinquish its old franchise and accept such a permit, with the strong protection against needless or wasteful competition which it insures. The days of political bickering for franchises in the Hoosier State are therefore numbered, and in their place has come a saner era of public-utility regulation under which, judging from the results elsewhere, the stability of public-service corporations will be increased and their development stimulated. So much for the opportunities under the new law. The next question, and one of the gravest importance, is the selection of a thoroughly competent commission to administer the law. Here is an opportunity to duplicate the brilliant achievement of placing so effective and just a measure on the statute books. It is to be hoped that this progressive community will break away from precedent and appoint at least two members out of the five on the new commission on the basis of their technical qualifications. We cannot urge too strongly that one member be an engineer of eminent qualifications and one an expert accountant. If to this there be added an economist of repute, a lawyer of broad experience and a fifth member with a special knowledge of transportation questions, the balance will be exceedingly satisfactory and much superior to a commission overbalanced with members from the legal profession.

Getting Ready for Moving Day

A tenant serves notice on the electric company that he intends to vacate his present quarters and asks that his meter be removed and a bill rendered. A man from the storeroom goes out, pulls down the meter and takes it to the shop. Next day the new tenant calls up the office and orders electric service, insisting that he must have it that same evening. Half an hour later tenant No. 1 sends in an agonized appeal from his new quarters, explaining that he had thought the premises were supplied with electricity but that service has in some way been disconnected. Of course, he too wants his meter in by nightfall. Notwithstanding the fact that the company removed its connections from the latter location less than twenty-four hours before, it will have to send out its metermen and replace the same meters, or other ones in their stead, on the identical hooks from which they were just pulled down. Of course, such a wasteful system is expensive for the company, and it is hard on the metermen and hard on the meters. In one Central Western city where the semi-annual hegira of dissatisfied renters numbers several hundred the local manager has arranged the blank form reproduced on another page, by means of which record is kept of each prospective removal, date, name and address of the new tenant, etc. In this way, with the aid of the clearing-house principle, all the effort and expense of changing meters is saved and customers are spared the annoyance of being without light during the trying ordeal of "moving."

The Supply Dealer as a Business Man

Statistics show that barely one merchant out of twenty who engage in retail business in this country makes even a living success of his undertaking. The other nineteen, because they overlook the simple precautions of determining their selling costs and profits, are inevitably pushed to the wall. Nowhere is this sad condition more forcibly illustrated than among the ranks of the small contractors and dealers in electrical supplies. Usually good workmen of excellent mechanical instincts, they are notoriously poor business men, and this failure to recognize the rules that govern grocery and dry-goods merchants has led to their own lack of success and the embarrassment of those with whom they deal. In retail selling the fundamental requirement is to provide a profit, either on the individual articles or the annual sales, sufficient to cover the direct charges, "overhead" contingencies and a reasonable surplus. Ascertainable overhead expenses include rent, light, heat, wages, advertising, insurance and freight. Reasonable interest must next be allowed on the capital invested. The third charge is for contingencies, and here is found the source of much trouble, because contingencies are unforeseen and impossible of exact calculation but are annual occurrences and must be provided for. They may be detailed in part as follows: Natural depreciation of stock, depreciation through mistakes in buying or overbuying, dishonest employees, losses by individual bad debts, special sales or extra advertising in backward seasons. A simple plan for calculating selling price based on earning a given gross profit above the cost price is contained in a bulletin recently issued by the National Association of Credit Men. From 100 per cent subtract the percentages of operating expenses and net profit. Divide the cost of the article by the difference; the result will be the necessary sales price. Such a simple rule will place the dealer's business on a substantial basis—for which stability there is often sore need.

A Startling Hydroelectric Undertaking

We commend to the attention of all cautious and conservative hydraulic engineers the description we print this week of a hydroelectric station that pumps part of the supply for its own wheels by electrical energy. To the first thought of the uninitiated it seems a bit like lifting one's self by one's boot straps, or carrying to a triumphant conclusion the favorite scheme of perpetual motion. On the contrary, it is a singularly clever and ingenious method of conserving water supply in a territory where water is precious and the available amount limited. The situation is briefly this: A plant working on the somewhat scant and variable supply of a mountain stream, fortunately rendering available a head of over 1000 ft., at certain seasons of the year found itself painfully short of water. Had there been a second stream available, it would have paid to go to considerable expense to add its flow to that of the primary source of power. This has often been done to meet the exigencies of increasing load and stationary water supply. In the present case no such auxiliary stream was available at or near the level of the main supply. A group of springs, however, at a lower level gave hope of additional water in paying amount, and the bold expedient was adopted of pumping this water supply to the level of the main headworks by electric power. And a cubic foot of water which one can drop more than 1000 ft. on to the wheels below by pumping it less than 150 ft. is not a source of energy to be held in contempt.

The project as actually carried out involves an automatic pumping station driven by the simplest form of induction motor directly coupled to a centrifugal pump capable of delivering 3.5 cu. ft. of water per second against a head, including friction, of 138 ft. The little pumping plant requires no attention. The result is very interesting. Except in May and June, when the primary water supply outruns the capacity of the pipe line, it pays to pump the spring water. At normal load it takes 67 kw to deliver the 3.5 cu. ft. per second at the upper level, and this quantity of water represents 237 kw at the generators below. There is, therefore, obtainable at the expense of the pumping plant 170 additional kw for ten months in the year, rising to a yearly output of nearly 1,250,000 kw-hr. It is sufficiently obvious that this additional supply, as large as that delivered by the central station in many a small Eastern city, is a valuable asset. In point of fact, the saving would be more than enough to pay for the pumping plant in a single year. Altogether this installation is a startling example of the resourcefulness of the Western hydraulic engineer when he is really face to face with difficulties.

Magnetism and Elasticity

Many investigations have been made at different times into the varied interrelations of magnetism and mechanics. Thus, when a bar of soft steel is magnetized longitudinally its dimensions are found to be slightly altered. The magnetization in the steel sets up of itself a condition of stress in the metal. Is the alteration in the dimensions accompanying magnetization due to this associated stress or is it due to some independent molecular change in structure which is merely modified by the stress? These and many other questions have been propounded by physicists, who have sought for experimental answers in the laboratory. The answers have been in some cases clear and easily understood. In other cases they have been difficult to interpret and seem to be affected by a variety of complexly associated influences. It is fair to say that many of the phenomena connecting the mechanics and magnetics of iron and steel are still very obscure.

It cannot be said, however, that all of the questions propounded by physicists are of merely theoretical or speculative interest. Some of them are already of vital practical interest to the industry, and others are rapidly assuming such interest. In dynamo-electric machinery magnetic stresses are often in excess of a ton-weight per pole, while the mechanical stresses involved, both tangentially during acceleration and radially at steady speeds, due to centrifugal forces, may be very considerable. It is necessary that the designer of dynamo machines involving large mechanical stresses per unit of cross-section shall be informed concerning the tensile strength of the steel and structure he employs in his design. The tests of tensile strength are ordinarily conducted on sample prisms, or test pieces, of the material, in an unmagnetized state. Does any appreciable correction need to be made for the effects of magnetization, seeing that in actual operation many of the rotating parts are powerfully magnetized? Is the elasticity of these parts increased or decreased by the magnetization?

In the article by Mr. F. J. Kean which appears in this issue some measurements are described of the elasticity (Young's modulus) in steel bars before and after being longitudinally magnetized. Young's modulus of elasticity may be described as the tensile stress per unit cross-section which would have to be applied to the material considered in order to double its original length, as inferred from actual stresses involving very small stretching, on the assumption that proportionality between stress and stretch continued throughout so great and ordinarily unattainable a range. Consequently, the greater Young's modulus for any material the stiffer and stouter the material is, at least within the observed limits of stress and stretch. The results given in the article go to show that when strongly magnetized the steel bars tested increased, on the average, some 2 per cent in Young's modulus of elasticity, and consequently it would take some 2 per cent more stress to stretch them, say, 0.1 per cent after being magnetized than before. In other words, these test bars were strengthened slightly in tensile elasticity after being magnetized.

Although the results here reported are satisfactory from the designer's standpoint, as indicating a gain rather than a loss in structural strength of dynamo steel under magnetization, yet it would manifestly be unsafe to assume that the whole question is thus settled from the designer's viewpoint. In a dynamo machine the steel employed is by no means always of identical quality and composition. The magnetic stress is not continually applied. Some vibration tends, moreover, to be set up in the pole pieces during their rotation. Further information is, therefore, desirable as to the influence of each of these variables, both singly and conjointly. It might be possible to have the elasticity re-

duced in some brands of steel while it was increased in others. An effect might be found for the influence of duration of magnetization, or of alterations and intermissions of magnetization, with or without vibrations or changes of temperature. It becomes evident, after such reflections, how deep and thirsty is the vacuum of engineering and industrial uncertainty into which we pour, year by year, an endless stream of new knowledge derived by the labors of exact scientists.

Popularizing Electric Service

The Society for Electrical Development, Inc., of whose first notable conference a full report was given in our last issue, has for its frankly expressed purpose thorough, efficient and extensive "boosting" of the electrical industries. The time of dog-in-the-manger competition in electrical affairs has fortunately long passed, and the organization of a society for united effort in helping the growth of all branches of the electrical business is significant evidence that an era of team work has opened. The men at the head of the new society are of long experience and keen judgment. They know not only what has been done in electrical industries but what infinite room there is for still further progress, and they are getting together to accomplish definite results. The chief difficulty in carrying through such work as the leaders have in mind lies in the great diversity of electrical interests and a natural feeling of uncertainty as to the proper place to begin in efficient "boosting." The consumption of electrical goods and electrical energy in this country has already risen to a prodigious amount, probably in excess of two billion dollars a year, and yet it is a fact of which every alert man is aware that electrical goods and electrical energy have not yet come fully into their own in the popular life of the country. The general function of the society is to bring this general public into close touch with what is being done in the electrical field. Enormous as the advances in electricity have been and greatly as the output of energy has increased all over the country, it is yet a fact which admits of no doubt that electrical service has not thoroughly passed from the stage where it is a luxury to the stage where it is a necessity. It is still looked upon as belonging in the category of luxuries in spite of lowered prices and industrious exploitation.

It is a fact that must not be forgotten that while through the past decade the prices of everything which has to do with living expenses of the individual or the family have risen to an astounding degree, through this same period the average price of electrical energy has steadily and greatly declined. It is the one necessity of modern life which has suited itself to the necessities of the wage-earner during a period of rapidly rising prices. Nevertheless, a statement of this fact always brings a touch of surprise to the average man to whom it is made, and in his daily life he does not act as though electrical service were a commonplace necessity. Despite the fact that to-day most Americans have become dwellers in cities and large towns, and despite the fact that electrical networks are ramified all over the country, it is still a fact that of about ten million or so buildings in which men dwell hardly one in five is supplied with electrical service. It is still a fact, also, that in large cities, where electrical energy is relatively cheap and accessible, this meager ratio is not materially better. The same condition holds true of the general uses of electricity for motor and miscellaneous service which fall within the practical experience of the ordinary man.

One of the greatest tasks which the new society can accomplish is to break down the limitations of this condition and prove to the man on the street, as the representative of the general public, that electrical service is in his interest and that he must look upon it as a necessity. We are sorry to say that the central stations themselves are not always without blame in this matter. They have too often affected to despise the small consumer and have put him out of the game in making their schedules of prices, without a moment's thought as to the ultimate future of the business. The station that fears to take on the small consumer or believes that it cannot make a profit out of him is in line for decreased business and needs an immediate change in management.

The time has come in the growth of all the electrical arts when universal use is a thing to be sought, not carefully selected employment by a small group of customers whose business can be easily coddled. If the huge investment in electrical things in this country is to be vindicated in the future, it must be by proving to the public at large that electricity is to become a part of the daily life of the whole people. A tremendous amount of missionary work of every kind is needed to this end; but in such particulars actions speak louder than words, and no amount of skilful publicity will build up increased consumption against the handicap of poor service or high prices or schedules arranged so that the few gain and the many lose.

We are just beginning to come within view of the great general uses of electrical energy. The whole field of electrical heating and cooking and the minor miscellaneous uses of a similar sort has barely been touched. We say this advisedly in spite of all the excellent work which has been done in the exploitation of some few heating appliances. Looking at the matter in the large, most companies have eliminated by their price schedules all business of this kind below a certain limit. That limit is not an impassable one. Below it business can increase to almost an indefinite extent. Above it business will merely drag along as it has dragged in the past. One cannot sell energy for large motors for general industrial purposes on a 10 cents per kw-hr. basis, and he cannot cultivate the larger field successfully at even half this price.

The expansion of the electrical business is the object of the new society. It is in deadly earnest and has ample resources and enthusiasm. The finest and most effective piece of work it can do is to try to give some of this enthusiasm to the man on the street, to make him understand how much to his advantage electrical enterprise really is and how thoroughly it can and will actually keep in touch with his needs. The society must devote its energies to that kind of missionary work which shall make electricity appear to the public mind as a necessity, the production of which is to be encouraged and the application of which is to be welcomed as part of daily life.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Minnesota Electrical Association

(*By Telegraph*)

About fifty central-station and supply men attended the sessions of the first day of the sixth annual convention of the Minnesota Electrical Association, held at the Hotel Saint Paul, St. Paul, Minn., March 11, 12 and 13.

In his opening address President Eugene Holcomb, of St. Paul, referred with regret to the lack of interest shown in the association by members between conventions. He urged all-the-year-round work. The membership is now about equally divided, he said, between privately owned and municipal plants. It might be well, he suggested, if divisions were made of these classes. Continuous performance of association work is needed, and to that end he proposed that the executive committee should be a continuing body and should appoint the secretary. The recommendations contained in President Holcomb's address were referred to a committee consisting of Messrs. H. J. Gille, of St. Paul; R. E. Brown, of Mankato, and T. C. Gordon, of Little Falls. Mr. E. F. Strong, of Chaska, secretary-treasurer of the association, next presented his report.

On Tuesday afternoon papers were read by Mr. D. D. Lescohier, of the Minnesota State Bureau of Labor, St. Paul, on "The Prevention of Accidents," and by Mr. Ludwig Kemper, of Albert Lea, on "The Central-Station Manager." Both papers were well discussed. President Holcomb appointed a nominating committee, consisting of Messrs. B. W. Lynch, of Minneapolis; F. A. Otto, of St. Paul, and E. A. Aspness, of Montevideo.

The matter of organizing a geographic section of the National Electric Light Association did not come up on the opening day.

Others papers scheduled to be presented before the Minnesota convention on the following days of the session were: "Increasing Boiler Plant Efficiency," by a representative of the General Electric Company; "Central Station Sales Methods," by Mr. C. E. Van Bergen, Duluth, Minn.; "The University and the Central Station," by Prof. George Shepardson, Minneapolis, and "Report of a Diesel Oil-Engine Test," by Mr. E. A. Aspness, of Montevideo.

Several manufacturers made exhibits of their products.

New York Law Authorizing Lighting Districts

Governor Sulzer of the State of New York has signed the bill introduced by Assemblyman Schwartz granting to second-class cities of the State the right to establish, alter or extend special lighting districts for ornamental street-lighting purposes.

Los Angeles Section, A. I. E. E.

At a meeting of the Los Angeles Section of the American Institute of Electrical Engineers held at the Hollenbeck Hotel, Los Angeles, Cal., March 5, several papers presented at the New York midwinter convention of the Institute were abstracted and discussed, as follows: "Rating of Oil Circuit-Breakers with Reference to Rupturing Capacity," abstracted by Mr. F. W. Harris; "The Temperature Rise of Stationary Induction Apparatus as Influenced by the Effects of Temperature, Barometric Pressure and Humidity," abstracted by Mr. R. W. Sorensen; "Current Rating of Electric Cables," abstracted by Mr. Edward Woodbury. The papers were discussed by Messrs. E. R. Northmore, A. W. Nye, C. G. Pyle and O. C. Miller. Nearly sixty members and visitors attended the meeting, over which Mr. George A. Damon, section chairman, presided.

Arlington "Wireless" Received 2400 Miles Away in Daylight

The United States scout vessel *Salem*, which has been cruising in the North Atlantic Ocean testing the transmitting range of the new government wireless-telegraph station at Arlington, near Washington, reached Gibraltar last week. Despite the difficult sending conditions usually imposed by full daylight, the *Salem* was able to receive complete messages from the Arlington 70-kw station when at a distance of 2400 miles. Night transmission distances were considerably greater. With its own 10-kw set the cruiser returned messages to Arlington at 1300 miles. Both the Arlington and the *Salem* equipments are of the Fessenden type. The *Salem* reports an extremely rough eastward crossing. It has started on its homeward trip, during which the wireless experiments will be continued.

New York-Boston 310-Mile Run of Storage-Battery Car

A run of 310 miles from New York to Boston over the Hudson River and Boston & Albany routes was successfully made on March 6 by a new Beach-Edison storage-battery car. The trip was particularly interesting in that it demonstrated to representatives of steam roads for which the run was made that this type of self-propelled car can maintain high average speeds for distances considerably in excess of 100 miles.

Mr. Ralph H. Beach, of the Federal Storage Battery Car Company, was in charge of the experimental run, which was made with a party of representative railroad and electrical men. The car used is 50 ft. long over all, 12 ft. 6 in. high and 8 ft. 11 in. wide, and weighs complete with load 34.6 tons. Seats are provided for fifty passengers, although on the trial run the car carried a combined load equivalent to eighty-four passengers. The electrical equipment of the car includes four 20-hp, 220-volt Diehl motors and two sets of 230 cells, each of Edison A-8-H storage battery, delivering energy to the motors at approximately 240 volts.

The route followed provided a variety of track conditions, including a long run at level grade, several climbs and considerable curved track. The batteries were fully charged when the car left New York at 9 a. m., and the run of 114 miles to Hudson was made at an average schedule speed of 35 miles per hour. On arrival at Hudson the car climbed 1½ miles of 2 per cent grade before recharging. The energy consumption for the level run of 114 miles was 37½ watt-hours per ton-mile.

The car arrived at Springfield, Mass., 98 miles distant from Hudson, with about one-third of the full charge left in the batteries, and this after having climbed the Berkshire Hills to an elevation of 1450 ft. and negotiated many grades,

including one continuous up-grade of 1 per cent for 8 miles. At Springfield the battery received a short boosting charge while the party had dinner. The remainder of the run, 98 miles, to Boston was covered without event.

Spokane Section, A. I. E. E.

The first meeting of the Spokane Section of the American Institute of Electrical Engineers was held in the Hotel Spokane at noon on March 3. There were present fifty men, of whom eighteen were petitioners with the right to vote. Mr. J. B. Fisken was elected temporary chairman and Mr. H. B. Peirce temporary secretary. Committees on by-laws and on membership were appointed and the meeting adjourned until March 6. At the adjourned meeting, which was held at 8 p.m. in the Washington Water Power Building, the attendance was about forty. By-laws were adopted and officers for the present year elected as follows: Chairman, Mr. J. B. Fisken; vice-chairman, Mr. J. W. Hungate; secretary-treasurer, Mr. H. B. Peirce; executive Committee, Messrs. C. S. MacCalla, C. F. Uhden, Louis N. Rice and H. A. Shearer. After the election of officers a short paper on "Benefits to Be Derived from the Section" was read by Mr. D. F. Henderson. On vote of those present it was decided to hold the next meeting in the evening of March 18, with papers and discussion following a dinner of an informal nature.

Proposed British Electrical Publicity Scheme

"A general campaign that will set the nation thinking" is being advocated in the interests of the electrical industry of Great Britain by Mr. H. Clifford Palmer, publicity manager of the General Electric Company, Ltd., of London, one of the largest dealers in electrical supplies in the world. In an address which Mr. Palmer delivered last month before the British Institution of Electrical Engineers, Manchester Section, he declared that £30,000 ($150,000) would be needed to support such a year's publicity campaign as he proposed for the electrical education and instruction of the public.

"Individual efforts, while highly desirable, are not all-sufficient," declared Mr. Palmer. "In such an industry as ours, where all interests blend, results of infinite value might be obtained by co-operation. Local efforts might interest a town, but a general campaign would set the nation thinking.

"The public does not know all we have to offer it, all we can do for it, what advantages we can offer over coal, gas or oil; that the cost for electric light compares more than favorably with the cost for gas lighting; that breakfasts can be cooked on the breakfast table; that seventy-two slices of bread can be toasted for the cost of 1 penny for energy; that electric cooking reduces meat losses to the lowest possible level; that an electric iron provides the only clean, convenient and healthful method of ironing, and that it can be operated from any existing lampholder without the necessity for special wiring. How should it know all this unless it is taught? The public can be educated on extensive lines," insisted Mr. Palmer, "only by systematic, judicious, and practical advertising."

Coming to concrete plans for obtaining this publicity, the speaker suggested the establishment of a general fund to which manufacturers, central-station companies and contractors might contribute. This fund, he added, should be administered under the control of an expert. From £20,000 to £30,000 he estimated as being sufficient for one year's campaign.

Among the mediums for obtaining publicity Mr. Palmer outlined plans to make use of the daily newspapers, billboards, a central information bureau, circularizing schemes and electric signs. For the latter he proposed a system of animated, illuminated night displays which might be taken down after various "runs" in the metropolis and set up for re-display in provincial centers. Supplementing the central information bureau, Mr. Palmer suggested a series of local showrooms in outlying cities.

"Our associations must get to work," concluded Mr. Palmer. "We must make the publicity problem our study for 1913."

Important Code Change Suggested

In the official bulletin containing suggestions for changes in the National Electric Code, which will be considered at this month's meeting of the electrical committee of the National Fire Protection Association, there occurs this paragraph:

"Rule 68, Section d, second paragraph: Amend by placing a period after the word 'connection' in the third line and omitting the following words, 'and to make it difficult for it to be replaced when melted.'"

The condition in which the code will be left if the amendment should be adopted is shown from an examination of Section d of Rule 68, which is as follows:

"d. Construction.—The fuse casing must be sufficiently dust-tight so that lint and dust cannot collect around the fusible wire and become ignited when the fuse is blown.

"The fusible wire must be attached to the terminals in such a way as to secure a thoroughly good connection and to make it difficult for it to be replaced when melted."

It appears that if amended as proposed the code would tacitly approve the principle of the refillable fuse, or rather would open the way for the approval of suitable refillable fuses submitted for test at the Underwriters' Laboratories. It is understood that this change has been proposed by the advisory board of engineers of the Department of Water Supply, Gas and Electricity of the city of New York. This board consists of Messrs. Charles F. La Combe, chief engineer of light and power for the city of New York; F. J. T. Stewart, superintendent of survey, New York Board of Fire Underwriters; George F. Sever, consulting electrical engineer for the city of New York; J. C. Forsyth, chief inspector electrical department of the New York Board of Fire Underwriters; George E. Bruen, superintendent of the electrical department of the Suburban Fire Insurance Exchange, and Hubert S. Wynkoop, electrical engineer for the city of New York.

The Standard Inclosed Fuse

The advocates of the non-refillable cartridge fuse claim for it the following among other advantages: It was standardized ten years ago, and the fuse of any manufacturer will fit the clips of all other manufacturers. It provides what is believed to be a safe receptacle for a blowing fuse. It can be refilled only by the manufacturer whose reputation is at stake, so that proper workmanship is insured and amateur refilling is prevented.

The Refillable Fuse

The advocates of the refillable cartridge fuse make the following claims, among others, for their product: It enables the operator of a plant to save a relatively large sum annually by having the refilling done on his own premises. On account of the cheapness and convenience of refilling on the premises, its use overcomes the temptation to bridge the standard type of non-refillable fuse in order to save the time, trouble and expense of returning cartridges to the manufacturer for refilling or of buying new cartridges for replacement.

Opposition to the Proposed Change

Mr. Robert C. Cole, electrical engineer of the Johns-Pratt Company, has sent a communication to members of the electrical committee of the National Fire Protection

Association, in which he makes the following statements:

"It being physically impossible to design a refillable fuse so that it cannot easily be refilled with an improper fusible element, an exceedingly large element, an unsatisfactory heat-dissipating material, or for that matter without the use of any filling material at all, any or all of which methods of refilling will result in a device constituting a real fire hazard, it is manifest that such devices should not be listed in the code.

"The inclosed fuse of to-day is the result of a standardization effected by a committee of underwriters' and manufacturers' representatives in 1902 and 1903. These fuses were approved after the Underwriters' Laboratories had satisfied themselves that they would, in *just the form that they would appear on the market,* operate satisfactorily. They are now asked to approve a line of devices which will be submitted to them by the manufacturers in one form and which will be installed by the users after they have been refilled *in an entirely different form.*"

The Question of Cost

Mr. H. R. Sargeant, of the General Electric Company, has made the following analysis of the claim that the use of the refillable fuses results in a large saving to the consumer. He takes as a basis of comparison 100 200-amp fuses of the reloadable type, the list price of which is $4. On 100 fuses he figures the cost at the end of the first year at $401.50, this sum including 10 per cent of reloads at 15 cents each. At the same rate of reloading, the cost at the end of the second year would be $403, and at the end of the fourth year the total investment would be $404.50. For standard inclosed fuses of the same capacity the original cost would be $200, while 10 per cent of reloads each year at $1 each would make the investment at the end of the third year $230, or a saving in full for the inclosed fuse of $174.50.

Increasing the Fire Hazard

L. W. Downes, of the D. & W. Fuse Company, has prepared a list of seven reasons why a change in the code provision covering inclosed fuses will increase the fire hazard. His first reason is that the proposed change would take the control of reloading of inclosed fuses, and ultimately the entire inclosed-fuse situation, out of the hands of the Underwriters' Laboratories and place it in the hands of people who, through ignorance, indifference or carelessness, are entirely unqualified to undertake the proper reloading of any fuse. A further reason why the proposed change would increase the fire hazard, according to Mr. Downes, is that there would be no possible way in which the Underwriters' inspector could determine whether a fuse had been properly reloaded, unless the device was removed and taken entirely apart. It has been the experience of manufacturers, Mr. Downes asserts, that even those who are supposed to possess a certain amount of technical knowledge will demand that the capacity of a given fuse be increased beyond its normal rating by, for example, putting 400-amp links in a 200-amp casing. The manufacturers of approved inclosed fuses absolutely refuse such demands, but there is no way of checking such practices on the part of the individual user. On account of the patent situation, with many refillable fuses on the market, it would be necessary for dealers to carry a large stock of different makes of links. As they are not likely to do this, Mr. Downes points out, the use of improper links would be increased.

The Open-Link Fuse

The attitude of the division of inspection of the Department of Water Supply, Gas and Electricity, New York City, as set forth in the Electrical Code of the city of New York, can best be summed up by stating that, considering the ever-present tendency to bridge across standard inclosed fuses and to load refillable fuses improperly, it has gone on record as urging that the cartridge fuse be not used where the open-link fuse can be employed. That is to say, the fire hazard of the open-link fuse is well recognized and can be guarded against by proper inclosing boxes, while the cartridge fuse is sometimes improperly shunted or refilled and then presents an even greater hazard which is neither recognized nor provided for.

Famous Whitney Development Abandoned by Aluminum Company

(*By Telegraph*)

The Southern Aluminum Company, a French concern with French capital, has decided to abandon its hydroelectric development on the Yadkin River at Whitney, N. C., and to build a new dam several miles below the present site.

According to the tentative plans, the magnificent masonry structures at Whitney, comprising a solid granite dam of cut stone, 1000 ft. wide and 38 ft. high, the spillway of similar dimensions and material, at right angles to the dam, and the canal leading from the dam, will all be submerged and the entire investment, representing at least $3,000,000, virtually thrown away.

The new dam will be of concrete, about 1200 ft. long and 150 ft. high. Its construction will involve an expenditure of about $2,000,000. Notwithstanding reports that have been circulated, it is declared that the contract for building the dam has not yet been signed, although the presumption is that the Hardaway Contracting Company, of Atlanta, Ga., will have the refusal of it. The contract reported made with the General Electric Company some time ago for seven 5000-kw, 250-volt direct-current generators—which would have been the largest of their type in the world had they been built—has also been annulled pending investigations on the new site. Definite information regarding the new development will not be available for some weeks to come.

History of Whitney Development

The Whitney development as a whole has been watched with some misgivings ever since its inception in 1901. The late George Whitney, of Pittsburgh, was the leading spirit in the movement to establish an electric generating plant on the Yadkin River, and the development bearing his name antedated the hydroelectric developments of the Southern Power Company and of the other great syndicates in the South. Pittsburgh contractors built the dam, spillway and canal on what was said to have been a basis of cost plus 20 per cent. The work was the finest ever undertaken in the South, the granite being cut and set with instruments. Like nearly all subsequent developments in this region, the purpose of the development was to generate ten-hour to twelve-hour power for cotton-mill operation. By construction of 4.5 miles of canal, 40 ft. wide and having a depth of 18 ft., a head of 120 ft. could be obtained and approximately 45,000 hp developed.

In the panic of 1907-1908 the entire enterprise had to be abandoned. At that time the dam, spillway and canal were nearly complete, but nothing whatever had been done on the power house. French capital was heavily interested in the original developments, and since the same financial houses are represented in l'Aluminus Française, the present ownership of the plant is explained.

Purchase by Southern Aluminum Company

After the Southern Aluminum Company acquired the property, at a price placed by rumor at $750,000, it established offices and engineering quarters at Whitney, proposing to undertake its own engineering work. Up to within a few months ago Dr. Heroult, the well-known French engineer, acted in an advisory capacity, but he has since

severed his connection with the company. The Hardaway Contracting Company was engaged to complete the work and to grade the property there, but this work has also been stopped.

To a representative of the *Electrical World* the reason given for abandonment of the Whitney development was that the site does not permit sufficient storage of water for twenty-four-hour operation. By locating farther down the stream a higher head is obtainable and water will be backed up the river for a distance of about 9 miles, submerging the top of the masonry dam at Whitney at 2 ft. The exact pondage afforded by the new site and the contemplated dam has not yet been determined, nor has the type of electrical and mechanical generating equipment been settled upon.

Electrical Problems Involved

There are many interesting engineering questions involved in the development. For manufacturing reasons the company would like to employ direct current at a tension of 250 volts, and while the General Electric Company was willing to build such 20,000-amp machines running at a speed of 170 r.p.m. the Westinghouse Electric & Manufacturing Company is understood to have recommended through Mr. Lamme double 10,000-amp machines. This recommendation, it is understood, was made because of the engineering problems involved in collecting the heavy current and in arranging suitable brush rigging.

The change of site will, of course, necessitate changes in the contemplated generating equipment, depending on the location of the aluminum plant. If 250-volt operation is no longer feasible, the General Electric Company is preparing plans for a 500-volt direct-current layout, using alternating-current generating equipment with rotary converters. To locate the aluminum plant at the power house will require extensive grading of the hillside, costing considerable money. On the other hand, if the aluminum plant is located even a short distance from the generating station the feeder investment, supposing that seven 500-kw, 250-volt units are still retained, will be prohibitive. The company owns 10,000 acres of land along the river and at Whitney, although the nearest bauxite deposits are said to be at Rome, Ga.

Plans for the Future

Offices will be maintained at Whitney, it is declared, where also will be located the residences of the operating heads. If it is finally decided to locate the aluminum plant there also, alternating-current equipment with rotary converters will naturally be selected. No contracts have been placed for any equipment as yet, but a conference of engineers will be held within the next two weeks. The S. Morgan Smith Company and the I. P. Morris Company are at work on tenders for hydraulic equipment and the large electrical companies have had engineers on the site going over electrical details.

The Yadkin River has a number of hydroelectric developments along its banks, although the stream flow varies between wide limits from the floods of winter to low water in summer.

While storage will enable the plant at Whitney to meet certain emergencies, only the natural flow of the river can be depended on should twenty-four-hour operation prevail.

The Southern Aluminum Company has had a large organization at Whitney for about a year, and, inasmuch as it appears to be able to command plenty of money, many believe it is a part of the so-called aluminum trust. A man prominent in engineering and business circles in the South has prophesied, however, that if the tariff is taken off aluminum the development below Whitney will never be completed. Mr. W. P. Marselleis, formerly connected with the Electrode Company of America, of Niagara Falls, N. Y., is the general manager of the Southern Aluminum Company.

The World's Highest-Head Water-Power Plant, 5400 Ft.

Construction has begun on a 15,000-hp water-power plant at Martigny, in the canton of Wallis, Switzerland, to utilize a fall of 5400 ft., making this station the highest-head water-power plant in the world. Special interest attaches to the penstock lines, which are 3 miles in length. The upper section, which will be under comparatively light hydraulic pressure, is being built of welded steel pipe, 23.6 in. in diameter. The lower section, which will withstand a hydrostatic pressure of nearly 2500 lb. per sq. in. or 165 atmospheres, is to employ special ingot-pressed seamless steel pipe. The tube sections vary in wall thickness from 1.24 in. at the top to 1.77 in. at the region of highest pressure. The turbines, which will be of the Pelton type and have a total rating of 15,000 hp, will be furnished by Piccard, Pictet & Company, of Geneva. Of some interest is the fact that with the 5400-ft. head available at this plant only about 30 cu. ft. of water per second will be necessary to develop the full 15,000-hp output of the station.

Great Falls Power for Sun River Reclamation Project

A contract just executed between the United States Reclamation Service and the Great Falls Power Company of Montana for electrical energy in connection with the construction of the Sun River irrigation project calls for 2500 kw throughout the period of the next six years.

The power company will transmit this energy a distance of 100 miles, delivering it to the Reclamation Service at a number of substations, from which it will be distributed to the several principal parts of the work. Proposals will be advertised for immediately for excavating the main canal, which will be 45 miles long. The diversion dam, 140 ft. high, and the diversion tunnel will both be constructed by government forces.

This use for electrical energy for excavating the Reclamation Service canal is not only a new departure but is believed to mark an epoch in such construction work. Great reductions in cost and time are expected to be accomplished with the new methods. The Great Northern Railroad Company completed the construction of a new line up the Sun River Valley last fall, and the Great Northern Railroad and the Chicago, Milwaukee & St. Paul each have a line under construction crossing the project, thus making four independent lines of railway across and along the irrigable lands.

There are already twelve towns within the limits of the project, and as many more have been planned. The electric service that will thus be already available when the land is opened to entry will be of great advantage in assuring these communities lighting and motor service for manufacturing and allied uses.

Bills in New York Legislature for State Hydroelectric Schemes

Our readers will recall that in the issue of Jan. 4, page 33, there was presented an analysis of the Bayne bill, which had the support of the New York State Conservation Commission in the last Legislature for the creation under State ownership of a State-wide hydroelectric system modeled after the provincial system of Ontario. Although this bill did not become a law, the Conservation Commission has been very active in arousing interest in the subject and numerous water-power bills have been put before the Legislature now in session. Several of these are rather comprehensive and of great importance to the public-service corporations of the State.

Bill to Amend the Conservation Law in Relation to Water Regulation

Another bill introduced by Senator Walters to amend the conservation law in relation to water regulation and utilization is quite similar in its general provisions to the preceding bill. Article 6, Chapter 647, of the Laws of 1911 would be repealed by the bill and a new article inserted which confers the following powers upon the Conservation Commission:

In addition to its other functions, the commission is authorized to regulate the flow of water, to acquire and develop sources of water supply, to improve watersheds, construct reservoirs, dams and other works with moneys appropriated by the State or furnished by water-storage corporations, to contract with municipal and other corporations for supplying them with hydroelectric energy or with water, to regulate stream flow, to make examinations and surveys of property required, and to prepare plans, specifications and estimates for all such undertakings.

In general, the commission is clothed with authority to carry out the provisions enumerated in the preceding bill introduced by Senator Walters. Authority is also conferred upon the commission to utilize or to sell all of the waters of the canals of the State, including the diversion rights, not necessarily required for navigation or for the safety of the canals. Canal waters or energy developed therefrom shall be disposed of under public contracts in the name of the State for a period not exceeding fifty years, upon permits and conditions in every case providing adequate compensation to the State.

Bill for the Establishment of Hydroelectric Plants and Districts

The most comprehensive bill yet introduced is that for which Senator Murtaugh is the sponsor, which would amend the conservation law in relation to hydroelectric plants and districts and would establish a hydroelectric plant for the capital district. This bill amends Chapter 647 of the Laws of 1911 by inserting a new Article 6 (a), the chief provisions of which are given in what follows:

At such points as the Legislature shall direct the Conservation Commission shall construct hydroelectric plants. Should the State adopt a state-wide hydroelectric system, the water-power districts already created will become part thereof, the rates being made consistent. For the operation of any such hydroelectric plant the commission may utilize canal waters, subject to the navigation laws and prior regulation.

A hydroelectric division would be created, in charge of a deputy commissioner at $7,000 per annum, assisted by a division engineer at $5,000 and such other clerks and assistants as needed. The commission is also to have authority to construct transmission lines and substations and to purchase or lease lines already built.

The general powers conferred upon the commission include the right to acquire property, to erect and maintain structures and works, to prepare plans, specifications and estimates, and to make examinations and surveys. All work shall be done under formal contract. The local authorities of any city or town within the hydroelectric district may apply to the commission for an estimate of the cost at which electric energy can be delivered to their municipality, cost of constructing the distribution system, cost of operation and conditions of proposed contract for service. Such application must specify the population of the municipality, the assessed valuation of property, the existence of any electric or power plant within the municipality, the number and character of industrial establishments and any other information that the commission may require. The commission at will may defer action upon such an application until a sufficient number of municipalities to afford a reasonable basis for making estimates have duly filed their applications. The annual payments must cover the 4 per cent interest on the State's investment, charges for a sinking fund which at the end of fifty years will completely wipe out the original investment, and an obsolescence charge of 2.5 per cent upon the cost of construction.

If a private plant is already in operation, the local municipality may enter into a contract with the owners to act as its general distributing agents, or it may purchase the existing plant at a price to be agreed upon with the owners thereof, subject to referendum vote, or the municipality may construct a distributing system at its own expense. A special election will be required to authorize or ratify the action of municipal authorities in any of these matters. The bill also provides for the creation in each municipality receiving such electric service of a municipal hydroelectric board consisting of the Mayor and two other members. The municipality may raise money to construct or purchase a distribution system either by direct taxation or by the issuance and sale of municipal bonds.

Every municipal corporation under contract will be required to post its rates for service in some public place and shall under proper regulations offer rates for the following classes of service: (1) Lighting of public streets, highways and buildings; (2) domestic and commercial lighting; (3) motor service for municipal purposes; (4) motor service for manufacturing or private use; (5) wholesale energy for public-service corporations. Municipalities will be required to keep their accounts in such form as the commission shall prescribe.

Any person or corporation located in a hydroelectric district, but in a municipality which has not contracted for electric service, may apply to the commission for a direct contract at rates to be agreed upon. The commission is required to devise a system of accounting for the hydroelectric districts and to make quarterly reports to the State Comptroller.

The final section provides for the creation of the "capital hydroelectric district" for the city of Albany and the construction of plants on the barge canal at Crescent and Vischer's Ferry, together with transmission lines, etc.

Hearings

At the hearings held in Albany by the judiciary committees many prominent officials urged the adoption of the proposed schemes. Among them, Lieutenant-Governor M. H. Glynn declared that the movement has the indorsement of Prime Minister Borden of Canada, who also favors the expansion of the Ontario system to other provinces. Messrs. G. E. Van Kennen and J. D. Moore, members of the State Conservation Commission, indorsed the measures, and several representatives of local business concerns urged their adoption. Others who appeared on behalf of the bills were Mr. W. J. Gloeckner, of the Albany Chamber of Commerce; Mr. G. E. Ward, of the Civic League, and officials of neighboring municipalities.

Among those who opposed the bills were Mr. R. P. Bolton, representing the National Electric Light Association, and Mr. Francis Blossom. Both of these witnesses testified that there is insufficient surplus water at Vischer's Ferry for a substantial development. Mr. Bolton contended that the hydroelectric system of Ontario is constantly losing money and characterized the proposed New York scheme as a socialistic plan of excessive expenditure and favoritism to a few interests in a small section of the State. Mr. George Clinton, of Buffalo, opposed the plan because, in his opinion, it threatened the water supply of the canals. Ex-Senator H. W. Hill, of Buffalo, Mr. N. B. Killmer of Brooklyn, and ex-Senator Edgar T. Brackett were also among those who opposed the plan. Ex-Senator T. Harvey Ferris, of Utica, head of the legislative commission that reported unfavorably on the Ontario plan, spoke briefly, defending the report that his committee made.

Representatives of the Merchants' Association of New

York City and the Citizens' Association of Brooklyn also raised objections on the ground that such legislation favored given localities at the expense of the people of the State as a whole.

Exhibition Arrangements for N. E. L. A. Convention

The exhibition committee of the National Electric Light Association, Mr. J. C. McQuiston chairman, has announced the arrangement made for Class D members' exhibits in connection with the forthcoming convention of the N. E. L. A. to be held at the Medinah Temple, Chicago, June 2 to 6, inclusive.

In the accompanying diagram is shown the booth plan for the exhibit hall which will occupy the lower floor of the Temple. This room measures approximately 100 ft. by 200 ft., leaving a booth area of 10,930 sq. ft. with sixty-eight booths. The committee will provide signs, railings, decorations, service outlet for electrical connection, telephone, etc., for each booth and has made arrangements with local firms for labor of all kinds, floral decorations, rugs, furniture, etc.

Mr. H. G. McConnaughy, 299 Broadway, New York City, is secretary-treasurer of the exhibition committee.

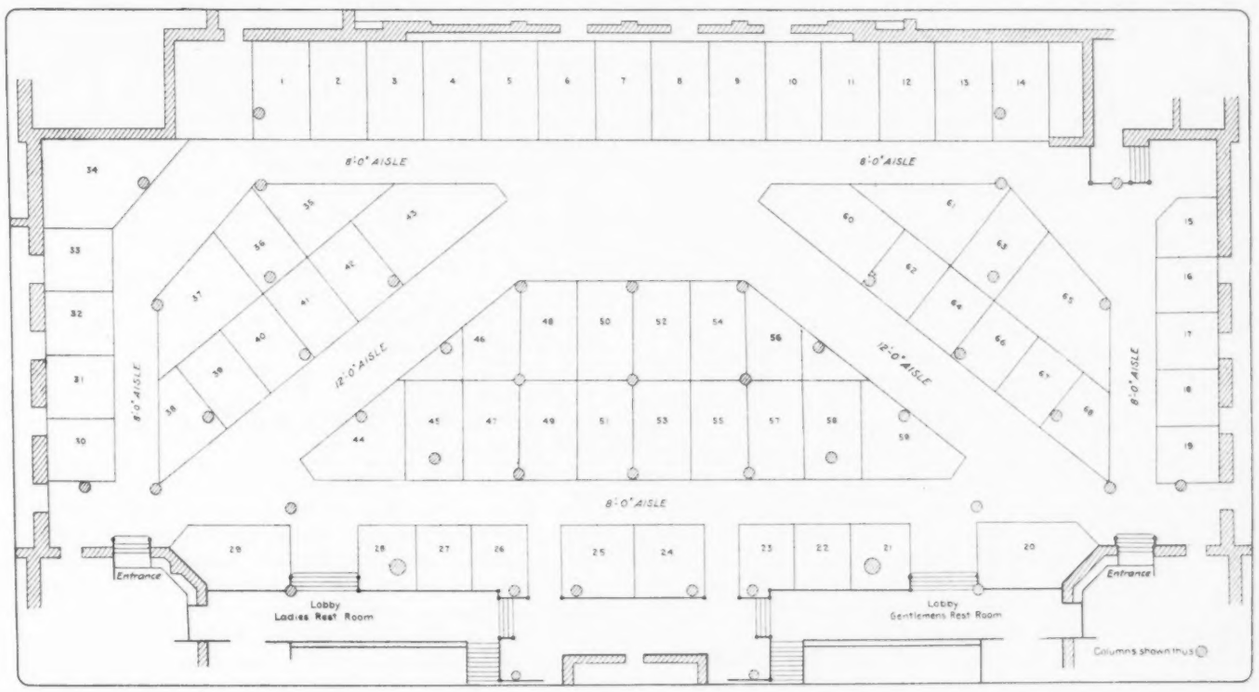


DIAGRAM OF BOOTH PLAN FOR EXHIBIT HALL

Energy for Panama-Pacific Exposition

A contract has been signed between the Panama-Pacific International Exposition Company and the Pacific Gas & Electric Company under which the latter will supply exclusively during the next three and one-half years the electrical energy required for all purposes during the term of the World's Fair in San Francisco in 1915 and during the period of construction and dismantling. Present estimates are that the exposition will require 20,000 hp. The gross amount of this business is estimated at $500,000. Simultaneously contracts have been made with the Pacific Gas & Electric Company for all gas and steam required by the exposition.

This is the first time that an exposition of the first magnitude has contracted for all of its requirements for energy with a single company. The Pacific Gas & Electric Company now has in operation electric generating stations with a rating exceeding 200,000 hp and is engaged in the construction of additional electric water-power plants with an ultimate rating of 165,000 hp, which, when completed, will give it a total generating rating of 365,000 hp.

The Indiana Public Utility Law

The Public Utility Bill recently passed by the Indiana Legislature, which becomes a law on and after May 1, is unusually comprehensive and definite and easily ranks among the model laws of this class already enacted by the various states. Its principal features are presented here in abstract.

The term "public utility" is defined in the act as embracing every corporation, company, individual, association of individuals, their lessees, trustees or receivers, and every city or town that owns, operates, manages or controls any street railway or interurban railway or any telephone or telegraph system, or any heat, light, water or power system, or any elevator or warehouse furnishing service either directly or indirectly to or for the public. The term "service" is employed in its broadest sense and includes not only the use or accommodation afforded to consumers or patrons but also any product or commodity furnished to them and the plant employed in such service. The term "indeterminate permit" is used in the act and means every grant directly or indirectly from the State to any corporation, company, individual, association of individuals, etc., of the power, right or privilege to own, operate, manage or control any plant or part of a plant for the production, transmission or furnishing of heat, light, water or power directly or indirectly to or for the public or for the transportation of street or interurban railway passengers or property, or for the furnishing of facilities for the transmission of intelligence between points within the State. Every such permit shall continue in force until such time as a municipality shall exercise its option to purchase the property as provided for in the act, or until the permit shall be otherwise terminated according to law.

The Public Service Commission of Indiana will consist of five members, not more than three of whom are to be members of the same political party. Each member shall be appointed by the Governor for a term of four years. The Governor shall also appoint a general counsel for a term of four years. Under the act the former Railroad Commission is abolished, and its rights, powers and duties are conferred by the act upon the Public Service Commission and continue in full force. The commission is empowered to select one of its own members as chairman. The salary of each member and of the general counsel will be $6,000 per annum. The secretary will receive $3,600 per annum and the clerk $3,000. Each member of the commission will be required to give bonds in the sum of $10,000 for the faithful performance of his duties. The commission is authorized to employ such attorneys, engineers, examiners, experts, accountants, etc., as it may deem necessary.

Sufficiency of Service

Each public utility will be required to furnish reasonably adequate service and facilities, and the charges made by all public utilities shall be reasonable and just. Every unjust or unreasonable charge for service is prohibited and declared unlawful, provided that nothing in the act shall authorize the charging of a higher rate than is provided by any franchise under which a utility is operating. Every public utility having tracks, conduits, subways or poles along streets or highways shall permit the use of the same by any other public utility for a reasonable compensation whenever public convenience and interest requires it and when such use will not cause irreparable injury to the owners.

Accounts and Reports

Every public utility will be required to keep and render to the commission uniform accounts of all business in such form as may be prescribed. Every public utility engaged directly or indirectly in any other or subsidiary business shall render separate reports thereof to the commission if so ordered. The commission will prepare suitable blanks and forms for carrying out its purposes. No public utility shall keep any other books, accounts or records except those prescribed or approved by the commission, unless required by some other public authority.

Every public utility must have an office in one of the towns or cities of the State in which its property or some part of its property is located and shall there keep its books and records. Every executive and general officer and the majority of the members of the board of directors of any utility company must be bona-fide residents of the State during their term of office. All accounts shall be closed annually on June 30 and a balance sheet taken as of that date.

Depreciation Allowances

Every public utility must carry an adequate and proper depreciation account whenever the commission after investigation shall determine that it can be reasonably required. From time to time the commission shall determine what are the proper and adequate rates of depreciation for the several classes of property on each public utility. The rates shall be such as will provide the necessary amounts over and above expenses of maintenance to keep the property in a state of efficiency corresponding to the progress of the industry.

Depreciation charges shall be set aside out of the earnings and carried in a depreciation fund which either may be expended for new construction extensions or additions to the property or may be invested, and if invested the income from the investment shall also be carried in the fund. This fund and its proceeds shall be used for no other purpose but depreciation, and in no event shall the money expended from the fund for new construction be credited to the capital account, but it shall always be charged against the depreciation fund. The commission shall keep itself informed of all new construction, extensions and additions to the property of public utilities and shall prescribe the form and manner of keeping the construction accounts, which shall clearly distinguish between operating expenses and construction.

Standards of Service

The commission shall ascertain and fix adequate and serviceable standards for the measurement and quality, pressure, initial voltage or other factors pertaining to the service rendered by any public utility and shall prescribe reasonable regulations for testing the quality of service. Reasonable regulations and standards shall also be established to secure accuracy of all meters and measuring appliances, and the commission shall provide for the examination and testing of any and all such appliances used by a public utility.

Rates and Tolls

Every public utility must file its rate schedules with the commission and must also keep copies of the same open for public inspection. This applies with full force to the joint rates or charges. After the act takes effect no change shall be made in rate schedule except upon thirty days' notice to the commission and the receipt of approval from the commission, unless the commission shall authorize a shorter period. No utility may charge or receive a greater or less compensation for any service performed by it than is specified in its public schedules.

The commission shall provide for a comprehensive classification of the service rendered by each public utility, which may take into account the quantity used, the time when used, the purpose for which used and other reasonable considerations. The commission shall have authority to inquire into the management of the business of all public utilities and obtain in any case all necessary information to enable it to perform its duties, including the right to inspect books, accounts, papers, records, etc., and to examine under oath any officer, agent or employee of a public utility in relation to its business affairs.

Stock and Bond Issue

The Public Service Commission is to have very complete authority over the issues of stocks, bonds, notes and certificates of indebtedness by public-utility companies. No public utility shall issue any stock or certificate of stock except in consideration of money or of labor or of property at its true money value, as found by the commission, or at such premium as may be approved by the commission.

No public utility shall issue any bonds, notes or other evidences of indebtedness except for money or labor or property actually received and equal to not less than 75 per cent of the value thereof. It is provided, however, that no bonds or notes shall be issued to retire or discharge any discounts incurred after Feb. 1 of the present year in connection with the issuance of bonds, notes or other certificates of indebtedness to be refunded or discharged.

The indebtedness of any public utility shall bear reasonable proportion to the total issue of capital stock, due consideration being given to the nature of the business, its credit, future prospects and earnings. Any public utility may, with the approval of the commission, issue securities or evidences of indebtedness payable at periods of not more than twelve months after the date thereof, when necessary for the acquisition of property, the construction of plant or the improvement of service, or for the lawful refunding of its obligations; or, again, for the reimbursement of money spent from the treasury and obtained from the issue of securities within five years next prior to the filing of application with the commission, assuming that the utility kept its accounts in the manner ordered by the commission. Whenever a public utility desires to make such an issue of securities it must file a full statement of its financial condition with the commission, and no issue will

be lawful unless it bears the approval of the commission.

Moneys received from the sale of securities shall not be applied to any purpose except that which is specified in the approval and order of the commission. The commission has not power, however, to authorize the capitalization of any franchise or the right to own, operate or enjoy any franchise whatsoever in excess of the amount actually paid to the State or to any subdivision thereof as the consideration for the grant of such franchise. When two or more corporations are merged the combined capitalization shall not exceed the sum of the capital stock of the corporations consolidated except for additional sums of cash actually paid out. No contract for consolidation or lease or merger shall be capitalized.

The act expressly states that the State of Indiana does not indorse or guarantee in any manner whatsoever any issue of securities of a public utility under the provisions of the bill. No public utility shall transfer or lease its franchise, works or system to any other person or corporation without the consent of the commission. No public utility shall directly or indirectly acquire the stocks or bonds of any other corporation engaged in a similar business unless authorized to do so by the commission. When the commission gives its consent, any two or more public utilities furnishing a similar service in the same locality may enter into contracts with each other which will enable them to operate their systems jointly. Upon the consent of three-fourths of the capital stock outstanding, and with the consent of the commission, any public utility may buy or sell or lease its property or business at a price and on terms fixed by the commission.

INDETERMINATE PERMIT

After this act takes effect no license, permit or franchise will be granted to any interest to own, operate, manage or control any public utility by any municipality where there is already in operation a public utility engaged in furnishing similar service under an indeterminate license, franchise or permit, except in the event that the commission has declared, after due public hearing, that public convenience and interest require such a second utility and the resulting competition.

Any existing permit, license or franchise which shall interfere in any way with the existence of a second public utility is declared under the terms of the act to be against public policy and is amended in such manner as to permit the grant of an indeterminate permit to a second utility under the terms of the act. The provision of the act making it mandatory to obtain an indeterminate permit after due public hearing applies with equal force to municipalities which desire to engage in furnishing public service in competition with one or more of the existing parties.

No license or indeterminate permit shall hereafter be granted or transferred except to a corporation duly organized under the laws of the State of Indiana or to a citizen of the State. Every license or franchise hereafter granted to any public utility shall have the effect of an indeterminate permit, subject to the provisions of the act and subject also to revocation by the commission for cause.

Any public utility operating under an existing license or franchise shall, upon filing prior to July 1, 1915, a declaration of surrender with the clerk of the municipality which granted it, receive by operation of law an indeterminate permit with all the rules and privileges thereunder which the act provides.

Every public utility accepting or operating under an indeterminate permit is deemed to have consented to future purchase of its property by the municipality in which the major part of it is situated at the valuation to be fixed by the commission under the terms of the act, without other recourse to law or the courts. The act sets forth the procedure which a municipality must follow in taking over an existing utility which it desires to acquire and operate.

PENALTY FOR VIOLATION

The act strictly forbids the furnishing by any public utility of free service, franks or special privileges to any person, patron or public officer, or to any political committee or candidate for public office. Violation of this provision is punishable by not less than one year's nor more than five years' confinement in the state prison, or by a fine of not less than $200 or more than $1,000.

If any public utility charges or receives more than or less than its published rate for service, the act is also punishable by a prison term or a fine. The same applies in case any public utility gives any particular person or corporation any undue or unreasonable preference or subjects any one to any undue or unreasonable prejudice or disadvantage in any respect.

Rebates are expressly forbidden and declared unlawful. Violation of any of the provisions of the act by any officer or agent of a public utility or by any officer of any town or city constituted a public utility is made a misdemeanor and punishable by a fine.

Every public utility will be required when an accident attended with loss of human life takes place upon its premises to give immediate notice thereof to the commission. In such event the commission, if the public interest appears to require it, shall cause an investigation to be made immediately and shall inquire into any neglect or violation of any laws of the State or the ordinances of any city or town by any public utility or its agents or employees.

The commission shall have the power and it shall be its duty to enforce the provisions as well of all other laws relating to public utilities. A sum sufficient to carry out the provisions of the act, not to exceed $75,000, is appropriated annually out of the state treasury.

Public Service Commission News

MASSACHUSETTS COMMISSION

The Massachusetts Railroad Commission has authorized the Bay State Street Railway Company, operating about 1000 miles of track north and south of Boston, to issue 6600 additional shares of preferred stock at $115 per share, the proceeds to be used in paying floating indebtedness. The funds raised will be applied in part as follows: New track and line construction or improvement, $83,178; cars, $68,476; power stations and equipment, $283,787; land and buildings, $63,458. The new preferred stock will be taken by the Massachusetts Electric Companies, under the provisions of the company's by-laws.

The Gas and Electric Light Commission has issued a decision sustaining the appeal of the Buzzards Bay Electric Company from a franchise granted the Barnstable Electric Company by the Selectmen of Barnstable to build and operate lines in that part of Barnstable known as Hyannis. The issue before the board was whether public necessity and convenience called for the admission of the Barnstable company into territory already occupied by another company able and willing to perform its duties. The service proposed at Hyannis and other parts of the Buzzards Bay district includes the supply of electricity to many summer residents. The board points out that to supply such a scattered territory with a maximum of efficiency and economy a single company with a properly located central station is preferable to numerous companies with independently operated stations, each the center of a small area of supply. No superior facilities were shown or claimed to exist in the Barnstable company. It appeared that before the controversy arose the Buzzards Bay company had planned and was undertaking in good faith the supply of this territory as rapidly as the growth of its business warranted. Its plans included the supply of other towns, and the board points out that while its investment and business in Hyannis

were small, it had irrevocably professed there its public calling and could not thereafter have legally or properly refused to supply electricity throughout the town of Barnstable to all who might reasonably demand its service.

Governor Foss has issued a statement reiterating his determination to advocate a public utilities commission with centralized powers in place of the existing tribunals for the regulation of public service companies. Within the past few days a movement has taken shape in the Legislature to create a transportation commission possessing some of the powers which the Governor has advocated, in place of the present railroad board. The Governor says that it would be particularly unfortunate at this time if a centralized board should not be established, and that a strong public demand exists at present for the creation of a commission with broader powers over a wider field than the proposed transportation commission would have. The present bill of the sub-committee on railroads is a re-draft of the Washburn bill and provides for the enlargement of the Railroad Commission from three to five members, for an increase of the salary of the chairman to $9,000 and that of the remaining four members to $8,000, and for mandatory powers, with appeal to the Supreme Court of the State rather than to the federal court, in order to save time in trying appeals. Thus far there appears little popular demand for the centralized commission plan which has been urged by the Governor for several years, and if the redrafted Washburn bill goes through, it is probable that the regulation of gas and electric companies, with the exception of electric-railway, telephone and telegraph companies, will remain in the hands of the Gas and Electric Light Commission. It is rumored that the Governor will veto any bill other than one providing for a centralized utilities board.

New York Commissions

With the return of the subway operating contracts from the Board of Estimate and Apportionment to the Public Service Commission for execution, negotiations will be consummated for the building and operation of the dual system of rapid transit which will give to New York City a subway and elevated system having 629 miles of single track and costing, for new work and new equipment, upward of $300,000,000. The approval of the operating contracts was noted in our issue of March 8. The only contract not included is the certificate for the third-tracking of the elevated railroads in Manhattan and the Bronx. This certificate originally was made out to the Manhattan Railway Company, owner of the elevated roads, which refused to accept it. The commission for the First District thereupon made out a new certificate to the Interborough Rapid Transit Company, as lessee of the roads. A public hearing on this certificate is set for March 15. The commission's vote on the adoption of the contracts was divided three to two, Chairman Edward E. McCall and Commissioners John E. Eustis and George V. S. Williams voting for adoption and Commissioners Milo R. Maltbie and J. Sergeant Cram against. Commissioner Maltbie proposed several amendments to both of the operating contracts, reducing the amount of the proposed preferential payments and making other changes in provisions to which he objected. The amendments were all voted down. Excluding the assignments of contracts Nos. 1 and 2, covering the existing subway, for which the new contracts will be substituted, there are eight different instruments involved in the new agreement. When all these contracts are signed the Public Service Commission will push the work of letting construction contracts on such portions of the new system as have not been already awarded. The most important of these are the extension of the existing subway from Times Square down Seventh Avenue to Park Place and under the East River to Brooklyn, and the Broadway-Fifty-ninth Street subway, running from the Queensboro Bridge to Seventh Avenue and down Seventh Avenue and Broadway to lower Manhattan and by tunnel under the East River to Brooklyn.

The Colliers Light, Heat & Power Company has been authorized to issue $25,000 of stock and $135,000 of mortgage bonds to acquire the property of the Clinton Mills Power Company, which operates in Cooperstown, and the Richfield Springs Electric Light & Power Company, which operates in Richfield Springs, both in the county of Otsego. The property of both companies now taken over by the Colliers company has been entirely rearranged so that the principal source of power supply will be the steam plant just acquired by the Otsego & Herkimer Railroad Company from the Hartwick Power Company. The water-power and steam plant formerly owned by the Clinton Mills Power Company will be used to supplement and as a reserve for the power to be taken from the railroad company.

California Commission

The Pacific Gas & Electric Company has applied for a rehearing of the case involving the reduction of rates of the Northern California Power Company. The applicant stated that the rates were unremunerative to both the Northern California Power Company and itself and asked that the rate order be suspended in so far as it applied to Butte and Colusa Counties.

A supplemental order has been issued allowing the City Electric Company to sell $833,000 of bonds which had previously been authorized to be pledged as collateral security for a loan.

New Jersey Commission

The New Jersey Board of Public Utility Commissioners has dismissed the complaint against the Public Service Electric Company, charging excessive and discriminatory municipal electric-lighting rates in a proposed schedule, brought by Raritan Township Dec. 16, 1911, and later joined in by East Newark, Montclair, Kearny, Harrison, Roselle Park and Jersey City. After inspecting the new rate schedule for street lighting filed by the company and investigating the justice and reasonableness of the increases shown in certain sections, the board holds that these rates will not bring to the company an unreasonable return on a legitimate investment. In the decision the board says that the new schedule shows a total net decrease of $100,200.98. While increases are made in the charges to some municipalities, the total number of such is small as compared with the total decreases. The board has decided that the increases do not afford sufficient cause for setting aside the schedule and further declares that the investment cost for conduits and pole lines which should be allotted to street-lighting service produces a lower average cost per lamp for a municipality with a large number of lamps as compared with a municipality having a smaller number. The board holds that "a sliding scale rate granting lower rates for larger installations is not unduly discriminatory or preferential, but a uniform price to all municipalities, irrespective of the number of lamps without reference to terms of the contract, would be unduly discriminatory."

The new schedule of the company is as follows: Thirty-one contracts for 890 arc lamps, former charge $74,539, new charge $65,886, total reduction $8,653; forty contracts for 10,708 lamps of 2000 cp, former charge $834,309, new charge $773,808, total reduction $60,501; fifty-five contracts for 1798 incandescent lamps, former charge $124,899, new charge $113,510, total reduction $11,389.

Ohio Commission

The application of the Columbus Railway & Light Company for permission to consolidate the railway and lighting interests at Columbus received a hearing before the commission on Feb. 28. President S. G. McMeen of the railway company explained that the consolidation is desired in order that the service of both the railway and lighting plants may be continued at existing rates and that such extensions and improvements may be made as are

needed. This service cannot be continued long under present arrangements, he said, since operating alone, the plants cannot give service on the most economical basis. This fact was realized some years ago, but then the only means available for operating the plants as a unit was the leasing plan. This has, however, proved too costly. Mr. McMeen said that at present it is necessary to keep nine complete sets of accounts, and that a large clerical force is needed. With the plants consolidated much of the clerical work can be eliminated. It was also shown that expenses in other directions are larger than they should be. The desired consolidation, it is declared, is needed in order that the present rates may be maintained and necessary extensions and improvements made. At the hearing no objection was made to the plan or the purpose sought, but Mr. W. A. Henry, the attorney representing the Columbus Light, Heat & Power Company, argued that the stockholders of this company are being treated unfairly in the proposed exchange of their stock. A brief will be filed with the commission setting forth his contention.

WISCONSIN COMMISSION

The question of state regulation of water-powers is again before the Wisconsin Legislature. A bill recently introduced provides for the construction and maintenance of dams across navigable rivers for the purpose of improving navigation or developing power under franchises to be issued by the Railroad Commission. No franchise is to be issued by the commission except upon a petition and a public hearing or upon an investigation by the commission upon its own initiative. The bill also authorizes the commission to regulate the level and flow of water, to pass upon and approve all plans and specifications relative to new construction or improvements and, in general, to supervise the construction, maintenance and operation of dams upon all navigable rivers in the State.

At the request of the city of Milwaukee, an investigation of the various phases of the local street-lighting problem has been made by the engineering staff of the commission, which will submit comprehensive recommendations to the city.

Current News Notes

WATER-POWER COMPANIES PROHIBITED FROM CONDEMNING SITES OF OTHER COMPANIES.—The North Carolina Legislature, at present in session at Raleigh, has passed a measure preventing water-power companies within the State from condemning water-powers of other companies under certain conditions. The 1907 act which made that possible has now been amended so as to restrain monopolization.

* * *

WEIGHT OF ICE-COATED WIRES.—In the course of an account of the effects of a recent sleet storm, the *Bell Telephone News,* of Chicago, said: "A coating of ice 1 in. in diameter on a telephone wire will weigh 1.75 lb. to the foot. A span between two poles which normally weighs 5 lb. grows to fifty times that weight, and three cross-arms filled with wires thus coated with sleet weigh about 4 tons. Such conditions crush and splinter the stoutest poles."

* * *

GOVERNMENT FORBIDS USE OF CARBON-FILAMENT LAMPS.—A recent order from the office of the Supervising Architect of the Treasury Department of the United States government is to the effect that carbon-filament, gem or metallized carbon-filament lamps must not be used in government buildings hereafter. Any such lamps in use at the time of the receipt of the order (which is dated Feb. 1, 1913) must be removed and 25-watt tungsten lamps must be substituted.

ELECTRIC ZONE TO NEW HAVEN BY JUNE 1.—The electrified zone of the New York, New Haven & Hartford Railroad is expected to be in operation to New Haven sometime in May. This will more than double the railroad's present electrified trackage, which extends from New York City to Stamford. The New Haven will then have about 35 miles under electric operation, including, besides the single-phase equipment, 12 miles of third-rail terminal tracks entering the Park Avenue tunnel and Grand Central Station. Several miles of overhead construction yet remain to be completed on the new Stamford-New Haven extension.

* * *

ELECTRICAL EXPOSITION PROCEEDS FOR INDIAN PAGEANT.—At the midweek luncheon of the Colorado Electric Club, Denver, March 6, it was decided to donate the proceeds of the 1913 Denver Electrical and Industrial Exposition to the Colorado Publicity League for use in preparing the Last Grand Council of the North American Indian, a pageant which will be held in Denver in 1915, contemporaneously with the San Francisco and San Diego expositions. Early Indian life will be represented, and several thousand Indians, cowboys and soldiers will take part. Phonographic and moving-picture records are to be taken for preservation. Nearly 200 attended the meeting of the electric club.

* * *

NO PERMANENT QUARTERS FOR ELECTRIC CLUB OF CHICAGO AS YET.—The question of securing permanent quarters was again discussed at the meeting of the Electric Club of Chicago on March 6. Secretary Rosseland gave the result of a postal-card vote on the subject. Out of a membership of about 375, 198 men voted on the question. To the query "Are you in favor of permanent quarters?" 159 answered in the affirmative and 39 in the negative. In relation to the proposal to raise the dues from $5 to $12 a year, 156 voted in favor of it and 38 opposed it. The attendance at the meeting of March 6 was 140. There was a good deal of discussion, in which Messrs. W. M. Connelly, O. B. Duncan, H. E. Niesz, W. D. Ray and others took part. A vote was taken on carrying out the recommendations of the special committee recently appointed, of which Mr. H. A. Mott was chairman, favoring the establishment of permanent quarters in the old building of the Hamilton Club. This proposition was voted down. However, the subject may be taken up again.

* * *

BANQUET OF WESTINGHOUSE MEN.—The third annual banquet of Westinghouse men in the Pittsburgh district was held at the Hotel Schenley, Pittsburgh, Pa., March 8. About 600 were present at the affair, which was given under the auspices of the Westinghouse Club. Mr. Charles A. Terry, of New York City, vice-president of the Westinghouse Electric & Manufacturing Company, acted as toastmaster and introduced the following speakers representing the Westinghouse interests: Mr. E. M. Herr, president of the Westinghouse Electric & Manufacturing Company; Colonel H. G. Prout, vice-president of the Union Switch & Signal Company, who spoke on "The Young Man and the Nation"; Mr. E. S. McClelland, chief engineer steam and gas department of the Westinghouse Machine Company, "Miscibility"; Mr. E. A. Craig, district manager Westinghouse Air Brake Company; Mr. H. H. Westinghouse, New York City, president the Westinghouse Traction Brake Company, "History," and Mr. Guy E. Tripp, chairman of the board of directors of the Electric company, "The Public." Mr. Robert Garland, member of the Council of Nine of Pittsburgh and an electrical manufacturer, the guest of the evening, made a forceful address dealing with local questions of government and advocating efficiency in municipal affairs.

"Wireless" Train Dispatching on Lackawanna.—The Lackawanna Railroad is equipping its stations at Scranton, Pa., and Binghamton, N. Y., with wireless-telegraph transmitting apparatus capable of sending messages 65 miles. The trains which pass these points will be fitted with receiving devices so that orders, messages, etc., can be transmitted directly to the train crews while running at full speed. Besides the regular work of train dispatching it is also planned to use the "wireless" to deliver messages to passengers, transmit news, etc. Mr. L. B. Foley is superintendent of telegraph for the Lackawanna. If this initial installation proves satisfactory, wireless apparatus will be installed throughout the system.

* * *

"Electric Foot Warmer" Exonerated.—Some attention was attracted among electrical men in Chicago recently by a daily newspaper item to the effect that an "electric foot warmer" in the house of a man in Wilmette, Ill., set fire to bed clothing and caused the house to catch fire. Inquiry reveals the fact that the fire was caused by a defective socket attached to a lamp cord leading to the bed, a lamp being used for reading purposes. It appears that the socket happened to be under the bed covers and a short-circuit occurred, setting fire to the bed clothing. The woman of the house said she knew the socket was defective but had neglected to have it repaired. Since the accident the extension cord and socket have been done away with entirely. Apparently no electric-heating pad was involved in the case in any way.

* * *

Nautical Training for College Men.—A plan has been proposed whereby the United States Navy in co-operation with the presidents of the universities and colleges of the United States will train a limited number of students on board battleships. According to the draft of the proposed general order students recommended by the proper authorities will be embarked in battleships and armored cruisers in full commission for a training period of two months' duration. No more than twenty students will be assigned to one vessel. All applicants must be over eighteen years of age and must have completed at least two years of their courses. Training will be given to successful candidates in the engineering, electrical, gunnery, navigation and boat departments, besides general regulations and routine of shipboard life. The training is to be thoroughly practical, embracing every opportunity for actual experience. The aim will be to ground each student well in one line of duties rather than give a smattering of several. As far as practicable, the choice of this specialization will be in line with the student's educational course at college.

* * *

SOCIETY MEETINGS

Mr. Erickson to Speak on Public Utility Laws.—Mr. Halford Erickson, a member of the Railroad Commission of Wisconsin, is to address a joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers at the rooms of the former on the evening of March 24.

* * *

Tri-State Water and Light Association.—The second annual convention of the Tri-State Water and Light Association of the Carolinas and Georgia, which was organized at Columbia, S. C., June 28, 1911, will be held at Charlotte, N. C., April 15 and 16. The officers of the association are: President, Mr. W. F. Steiglitz, Columbia, S. C.; first vice-president, Mr. W. E. Vest, Charlotte, N. C.; second vice-president, Mr. George Hubbard, Elberton, Ga.; third vice-president, Mr. B. F. Erwin, Atlanta, Ga.; secretary and treasurer, Mr. J. W. Neave, Salisbury, N. C.

Annual Meeting of the S. P. E. E.—During the week of June 23 the Society for the Promotion of Engineering Education will hold its annual meeting at Minneapolis, Minn.

* * *

Pleasure-Vehicle Problems to Be Discussed.—Informal luncheons of the Chicago Section of the Electric Vehicle Association are held every Tuesday in the Traffic Club on the eighteenth floor of the Hotel La Salle. On March 18 and 25 and April 1 it is planned to have short talks by representatives of manufacturers of pleasure cars.

* * *

Nebraska Electrical Association.—It is probable that the convention of the Nebraska Electrical Association will be held later this year than last, perhaps not until summer or early fall. Mr. H. A. Holdrege, general manager of the Omaha Electric Light & Power Company, is president of the association, which is a geographical section of the National Electric Light Association.

* * *

Jovian Chapter, St. Louis League of Electrical Interests.—At the luncheon of the Jovian Chapter, St. Louis League of Electrical Interests, March 4, President A. C. Einstein presented gold pins to Messrs. Burgess and O'Brien for obtaining the greatest number of new members. Mr. Richard McCulloch, vice-president and assistant general manager of the United Railway Company of St. Louis, read a paper on "Electric Railway Problems," dealing with subjects of track and car construction, scarcity of efficient laborers and supervision of traffic. Figures which he quoted showed that the number of St. Louis passengers who ride on transfers is 46 per cent of the number of revenue passengers, making the average revenue per passenger for the year 1912 3.31 cents.

* * *

N. E. L. A. Activities at Philadelphia.—Prof. E. E. F. Creighton, of Union College, Schenectady, N. Y., addressed the Philadelphia Electric Company N. E. L. A. section, Feb. 17, on the subjects of "The Protection of Electrical Circuits" and "Experiments at High Frequencies." The address was illustrated with both charts and actual demonstrations. Mr. J. C. Bartlett discussed electric vehicles before the commercial department branch, Feb. 24, presenting data on operating cost, energy consumption, etc. This branch now has 146 members. The manufacture of watt-hour meters was described before the February meeting of the meter-department branch by Mr. J. B. Mills, of the Fort Wayne Works of the General Electric Company. The newly formed engineering branch of the Philadelphia Section is now organized for work, with Mr. A. L. Atmore as chairman-elect.

* * *

Institute of Radio Engineers.—A paper by Dr. L. W. Austin, of the National Bureau of Standards, describing some experimental extensions of his recent work on the variation with frequency of condenser resistances, was read at the regular meeting of the Institute of Radio Engineers, New York, March 5. Although Dr. Austin was unable to deliver the paper in person, the subject matter aroused much interest and brought about a lively discussion The design of an emblem was submitted to the membership for final criticism, and it is expected that the form agreed upon will be ready for distribution at the next meeting, April 2. The Institute of Radio Engineers, which was formed by the consolidation of the Society of Wireless Telegraph Engineers and the Wireless Institute, is now well on in its second year. The membership is still growing rapidly, and meetings are held on the first Wednesday of each month at Fayerweather Hall, Columbia University, New York, with an average attendance of about fifty.

Mill Creek Automatic Pumping Station

Increasing the output of a Utah hydroelectric plant by the use of electrical methods to pump a portion of its water supply. By M. R. Lott

IN laying out hydroelectric systems it is sometimes possible to add appreciably to the output of an existing power station by introducing into the main flow line additional water from some source other than that of the primary supply. In many instances this can be accomplished with an expenditure of money which is small in proportion to the gain in power output of the station. In plants where the supply of power is equal to, or very little in excess of, the demand, the value of the additional capacity thus made available becomes very great, particularly during the low-water period.

Sometimes it is possible to gain the additional water by diverting some small stream or spring whose channel is at a sufficiently high elevation to allow its waters to be carried by gravity through a conduit to the main flow line. If, on the other hand, the source of the spring is at a lower elevation, it will be necessary to use a pump to lift the additional water to the main conduit. The latter method would be profitable only, of course, when the head against which the water must be pumped is small in comparison with the effective head available for use at the plant where the additional supply of water is required.

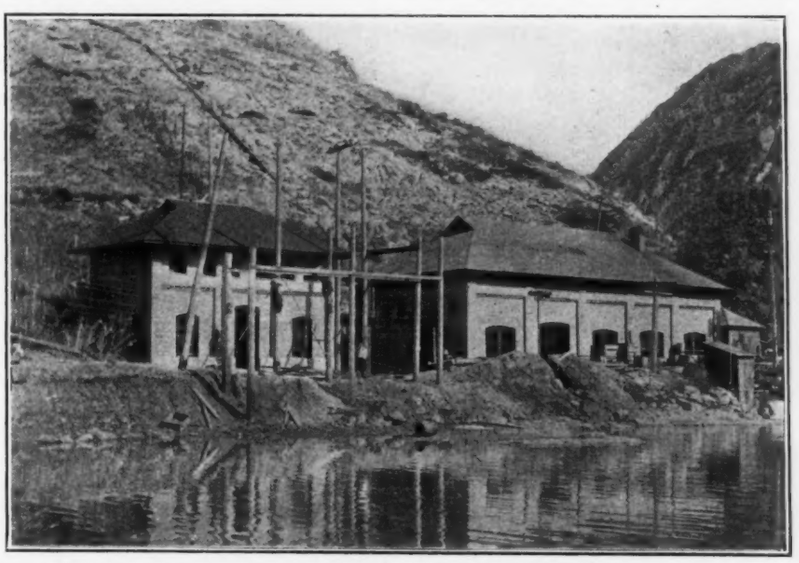


FIG. 1—LOWER MILL CREEK CANYON PLANT OF KNIGHT CONSOLIDATED POWER COMPANY, SALT LAKE CITY

An example of a profitable development illustrating the latter case is the Mill Creek pumping station of the Knight Consolidated Power Company, whose main offices are at Provo, Utah.

KNIGHT SYSTEM OF WATER-POWER PLANTS

The Knight Consolidated Power Company has in operation in Utah eight hydroelectric plants all located within a radius of 45 miles of Salt Lake City. These stations feed into a 40,000-volt transmission system, the output being used for lighting a dozen towns and for power purposes in the largest mining camps in the State. The mining load is a large and important one.

Most of the plants depend upon small mountain streams for their water supply and operate under rather high heads. These streams have a large flow during the high-water season (May, June and a part of July), but this later decreases to a fairly small run-off, reaching a minimum during the months of December, January and February. As the plants have to be designed with the fluctuating stream flow in mind, any method which will add to their available water supply, at the same time involving small installation and operating costs, becomes a valuable consideration.

The two plants of the system most intimately associated with the pumping plant to be described are those in Mill Creek Canyon, southeast of Salt Lake City. The lower plant, known as Mill Creek No. 2, is located at the mouth of the canyon, approximately 7 miles southeast of Salt Lake City (see Fig. 1). The upper station, Mill Creek No. 1, is situated about 5 miles further up the canyon. This rocky valley is one of the many small canyons in the Wasatch mountain range, and is a very narrow defile, having high rock walls which prevent the sunshine from reaching the stream bed during the greater portion of the day. The little mountain river winds its course down the narrow canyon bed, receiving additional water from various springs as it goes. Its character is similar to that of other mountain streams having the usual fluctuating flow of water. The accompanying table, which shows the amount of water in cubic feet per second available each month at the lower plant, is characteristic and illustrates in a very clear way the nature of the flow.

The water passing through the upper plant is discharged into the intake reservoir for the lower plant, the diversion works for the latter station being about 650 ft. down the canyon. A small concrete dam, approximately 20 ft. high, backs the water up to the upper plant, this forming a small reservoir with a storage of approximately 6 acre-ft., an amount of water equivalent to about 560 kw at the lower plant for eight hours.

PIPE LINE AND LOWER MILL CREEK PLANT

The intake to the pipe line is about 19 ft. below the crest of the spillway, and the pipe line itself leading to the lower plant is laid on a grade of 2 ft. per 1000 ft. The lengths and sizes of the various portions governing the net effective head are as follows: 25,094 ft. of 30-in. continuous wood-stave pipe, 334 ft. of 28-in. riveted steel pipe, 405 ft. of 26-in., 438 ft. of 24-in., 450 ft. of 22-in., 149 ft. of 21-in. and 367 ft. of 20-in. lap-welded steel pipe.

The static head is 1031 ft. An accompanying curve (Fig. 2) shows the net effective head at the power house for any discharge between zero and the maximum dis-

charge capacity of the conduit, 19.3 cu. ft. per second. This curve of effective head was computed by the Hazen Williams slide rule, using as values C = 115 for the wooden-stave and riveted-steel pipes and C = 100 for the lap-welded pipe.

There are two units at the lower plant, each consisting

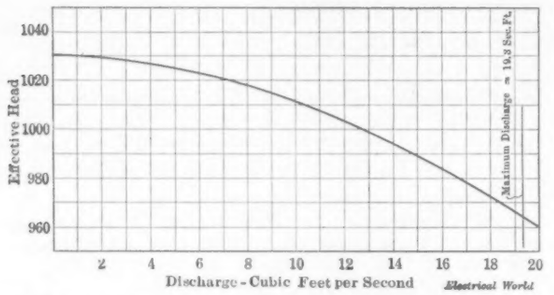


FIG. 2—CURVE OF EFFECTIVE HEAD ON LOWER MILL CREEK PLANT

of a Doble waterwheel direct-connected to a General Electric generator. Each waterwheel is capable of developing 1300 hp at 514 r.p.m. under an effective head of 990 ft. The generators are rated at 700 kva, 60 cycles and 2300 volts.

The curve in Fig. 8 shows the kilowatt output at 100 per cent power-factor for different quantities of water discharged through the wheels. This is a theoretical curve which was checked by actual test, using a water rheostat for load. The Lower Mill Creek plant does most of the governing for the system.

Springs and Pumping Station

Approximately half a mile down the canyon from the intake works for the lower plant a number of springs issue from the ground within a limited area. The flow from these springs, by weir measurements, varies from 3 second-ft. to 4.5 second-ft., depending upon the season of the year. By means of a small diversion dam and pumping plant it was possible to collect these waters and pump them into the main 30-in. flow line, thus increasing the available water supply at the lower plant and in consequence its available power output.

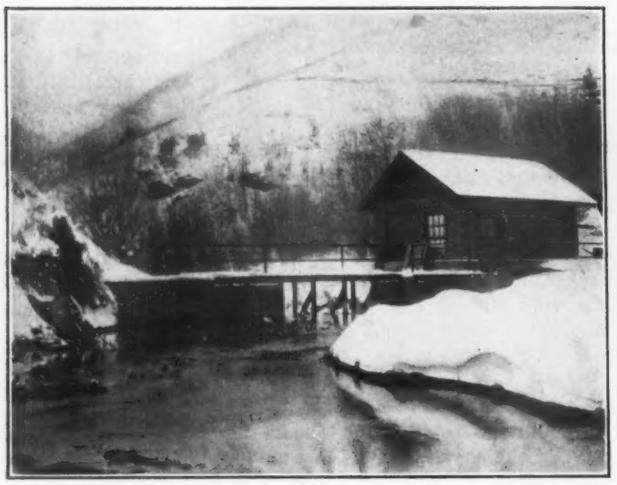


FIG. 3—DIVERSION DAM AND PUMP HOUSE

The diversion dam as built is made of concrete and structural steel and is provided with removable wooden gates. The concrete which supports the structural steel extends from the surface of the creek bed down to a solid foundation. One end pier ties into the station building foundation and the other extends 4 ft. into the mountain slope, thus preventing leakage of the collected waters. The steelwork consists of I-beams with angles riveted to them to form guides and supports for the wooden gates. Wooden gates made with tongue joints were used for damming up the water, so that in time of flood conditions they might be removed to allow the debris carried with the

WATER AVAILABLE AT LOWER MILL CREEK PLANT, 1912

	Maximum	Minimum	Average
January	9.36	8.88	9.16
February	9.10	8.45	8.82
March	10.56	8.85	9.30
April	16.44	12.43	14.62
May	51.84	16.61	30.91
June	56.00	24.50	37.00
July	18.99	12.61	16.38
August	17.67	13.47	15.26
September	13.59	12.68	13.11
October	12.57	10.73	12.01
November	12.16	11.09	11.56
December	11.50	10.07	10.90

rushing torrents to be taken down stream without filling the small reservoir which the dam makes available. A platform extends around the station building and across the dam, to facilitate the removal of these gates. The average depth of water at the gates is about 3 ft. 6 in.

The station building has a concrete foundation, brick walls and a shingle roof. It is 12 ft. by 16 ft. in plan and 16 ft. high. On the stream side of the building a weir is placed in the foundation wall to permit making tests. The floors are of concrete. Difficulty was encountered in excavating for the station building on account of numerous small springs which became apparent after the work of excavation had proceeded to a depth of 2 ft. From that point to the required floor elevation, about 6 ft. farther down, the work had to be carried on in mire. Solid foundations of the building walls were secured by sinking water-tight boxes till solid formation was reached, filling these with concrete and reinforcing the entire foundation. To secure dry floors, it was necessary to use two layers of concrete, leaving spaces for drainage between. A rough, thick floor was first laid to keep out most of the water; then forms were built for the drains, which were covered with a solid piece of sheet iron, and on this the top floor was laid.

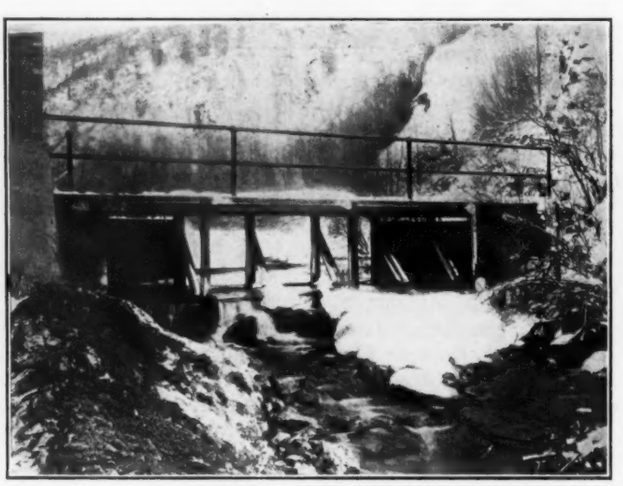


FIG. 4—DOWNSTREAM SIDE OF DIVERSION DAM, GATES REMOVED

Pump Equipment and Automatic Control

The water flows from the stream channel into a receiving well 6 ft. by 12 ft. and 7 ft. 2 in. in height, made by placing a concrete partition wall across the building. This is topped with a reinforced-concrete cover on which the motor-starting apparatus is placed. The horizontal pumping unit con-

sists of a Worthington single-stage, single-suction 6-in. centrifugal pump, direct-connected to a General Electric three-phase squirrel-cage induction motor, rated at 100 hp, 1800 r.p.m., 2200 volts, 60 cycles. Pump and motor are mounted on the same bedplate, the whole unit being placed so the shaft center line is 2 ft. 7.5 in. below the weir crest.

plant. A check valve is provided on the discharge side of the pump, and provision is made for draining the pipe line.

It was the intention to make the station entirely automatic in its operation, so that no regular attendance would be necessary. To accomplish this automatic motor control

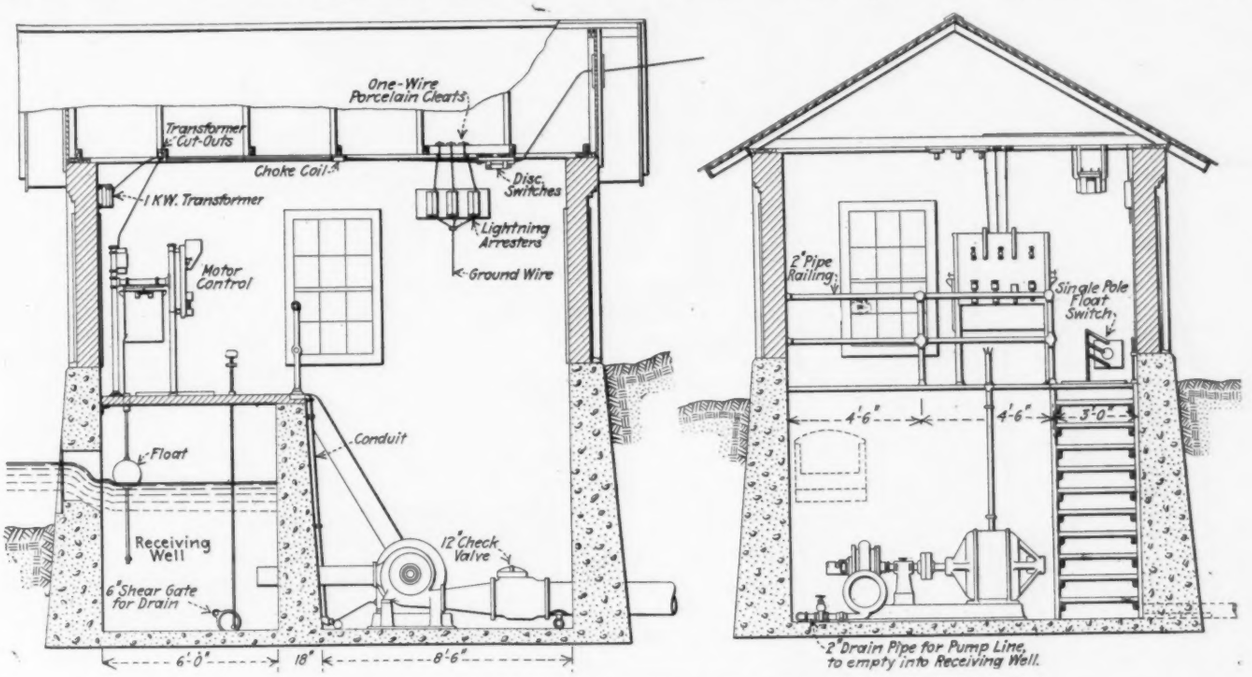


FIG. 5—ELEVATION SECTIONS THROUGH AUTOMATIC MOTOR-DRIVEN PUMP HOUSE

This arrangement does away with the troubles associated with foot valves and priming. Great care was used to secure an efficient pump and motor, for the feature of efficiency becomes of great importance in this type of an installation. Numerous copies of specifications detailing the requirements were sent to the various manufacturers, and from the replies to these the maker guaranteeing the most efficient machines, other things being equal, was selected.

The pump is designed to lift 3.5 cu. ft. of water per second in ordinary operation, the normal head against which the water must be pumped being 138 ft., including friction. The curve in Fig. 11 gives the performance of the

was required. A float switch operated by the change in level of the water in the receiving well controls through the automatic motor compensator the starting and stopping of the motor at the pumping house. This apparatus is mounted on pipe framework over the receiving well, together with the disconnecting switches, Garton-Daniels lightning arresters, choke coils, and the 1-kw transformer which is used in lighting the building and its surroundings.

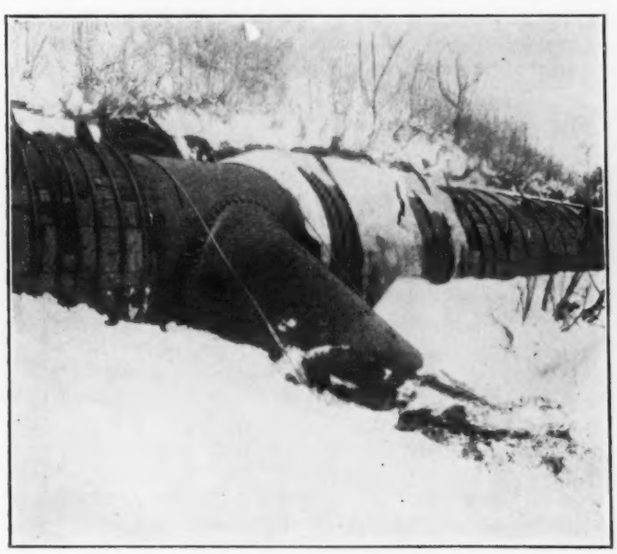


FIG. 6—T-CONNECTION WITH MAIN PIPE LINE

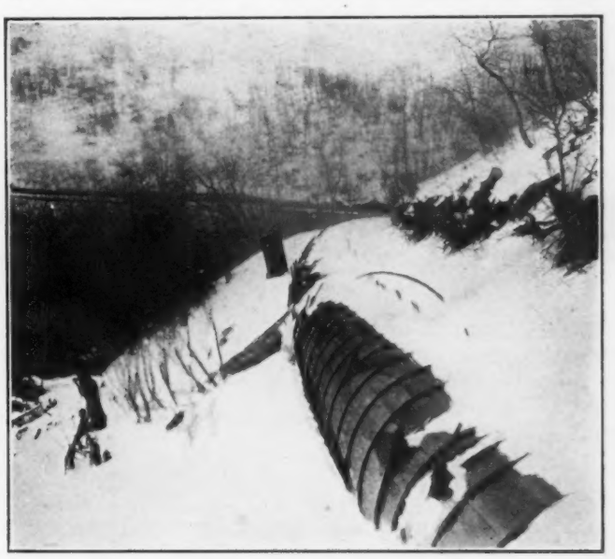


FIG. 7—30-IN. PIPE LINE IN CANYON

PIPE CONSTRUCTION AND TRANSMISSION LINE

A 12-in. wire-wound wooden-stave pipe carries the water pumped to the main 30-in. flow line. The size of pipe to be used was determined by balancing the value of the

power lost through friction against the interest and depreciation of the investment. The pipe is made of California redwood with a 1-in. net thickness of staves, except at those portions into which the steel fittings are inserted. No. 0 galvanized-iron wire is used for banding, with a spacing of 2 in. and 1.375 in. Steel elbows are employed

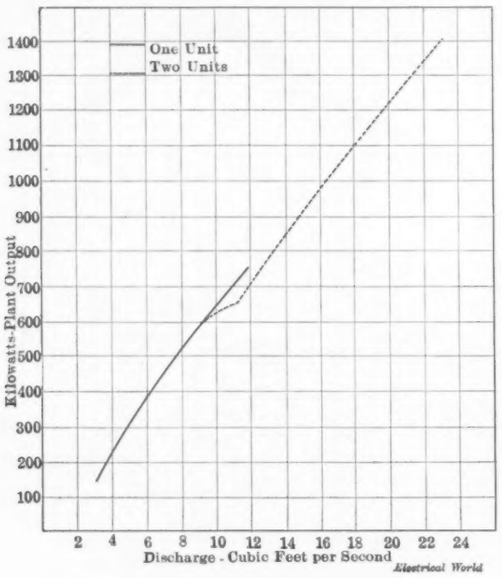


FIG. 8—OUTPUT, LOWER MILL CREEK PLANT

at angles, and a steel T-connection joins the 12-in. pumping-plant line to the main 30-in. flow line.

The connections between the steel fittings and the wooden-stave pipe are of the nature of slip joints, the rivets in those portions of the fittings which are inserted into the pipes being countersunk. In the 12-in. pipe line the inside diameter of the steel elbows was 12 in., the ends of the wooden pipe being reamed out to the outside diameter of the steel fittings. An increaser is supplied at the T-connection so that the velocity of the water will be decreased when it enters the 30-in. pipe, thus avoiding loss at that point. A gate valve is provided in the 12-in. pipe near the point of connection, while a vent pipe is connected in just

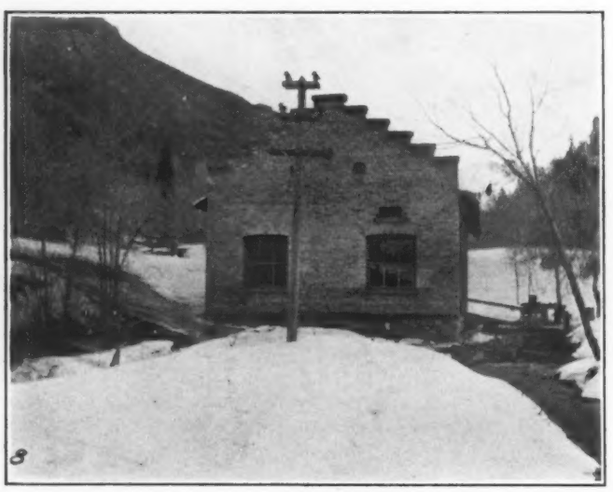


FIG. 9—UPPER MILL CREEK CANYON PLANT

below, so that the pumping-plant line may be emptied when desired.

The energy for driving the motor is supplied from the upper Mill Creek plant. A 22,000-volt line extends from this plant to the lower station, passing by the pump house, enabling the 2200-volt circuit for the motor to be mounted on the same poles, below the high-tension wires. The conductor is No. 6 medium hard-drawn copper wire, carried on glass insulators mounted on standard 1½-in. by 9-in. locust pins and standard 5-in. four-pin Washington fir cross-arms.

At the upper plant the line is fed from the station 2300-

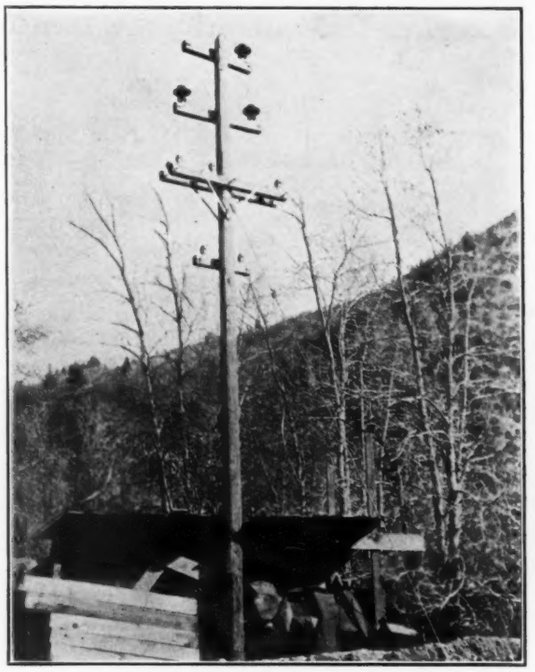


FIG. 10—POLE-LINE CONSTRUCTION, SHOWING 22,000-VOLT, 2200-VOLT AND TELEPHONE CIRCUITS

volt bus through disconnecting switches and an oil switch provided with overload trip coils. By means of a recording ammeter the station operator is able to keep track of what is happening at the pumping plant. Garton-Daniels lightning arresters and choke coils are also installed in the upper plant.

POWER VALUE OF WATER ADDED FROM SPRINGS

From the table of water available at the lower plant (other than that pumped) the output curve of the lower

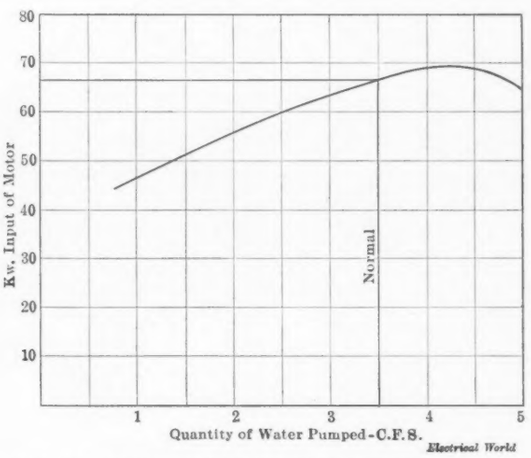


FIG. 11—PERFORMANCE CURVE OF PUMPING PLANT

plant and the performance curve of the pumping unit it is possible to estimate the value of the pumping installation. From the water-supply table it will be seen that during the months of May and June the water is in excess of the pipe-line capacity, so the use of the pumping plant is out of the question during those two months, but the

spring water is available for use during the remaining portion. From the output curves for the two plants it will be seen that the 3.5 cu. ft. per second will, on the average, be good for 237 kw at the lower plant, with a motor input of 67 kw, making a net gain of 170 kw. On the basis of having 3.5 second-ft. available during ten months, the total possible net yearly gain in energy resulting from the installation of the pumping plant will therefore be 1,224,000 kw-hr. Estimating that one-half of this could be sold at 1 cent per kw-hr., the saving would amount to $6,120. This is more than the initial cost of the pumping system and shows that the return on the investment can be very large.

Not only is the water supplied by the springs good for immediate use at the lower plant, but at times when it is not needed at the lower plant it can be pumped into the intake reservoir for storage until time of peak load.

The entire work described was designed in the engineering offices of the Knight Consolidated Power Company, and the actual construction and installation were let by contract to the lowest bidder. The total cost of the pumping-plant system was approximately $32 per net kw of rating gained.

Utilization of Pulverized Fuel for Boiler Firing

BY C. H. WRIGHT

The difficulties of securing perfect combustion with low-grade fuel are well known to all steam engineers, and an inspection of the smoke issuing from stacks and of the methods of stoking confirms the opinion that many common methods of firing are not economical. If finely pulverized fuel could be properly used, it would assist the steam engineers in a number of cases. Such coal blown into the kilns is commonly used as fuel in the manufacture of cement. To use the same material for firing boilers, it is necessary to have a proper mixture of air and to blow this mixture into a heated furnace. This combination acts somewhat as would a mixture of gases and to some extent has to be treated in the same manner to avoid explosions. As the mixture is not a perfect gas, care has to be taken that proper ignition be secured; in fact, to secure continuous ignition of a reliable nature it is necessary to have the mixture surrounded by incandescent firebrick or something similar.

There are a great many places where low-grade fuel or coaldust is available, and this is often found to have considerable heat value. It is unfortunate, therefore, if it has to be wasted and used as ballast for railroads or consigned to an unsightly and dividend-consuming dump.

Many experiments have been made during the past fifty years on the use of powdered fuel by blowing it into ordinary boiler furnaces, but anyone who has had experience with such practice will recognize the difficulty arising from choked flues and disintegrated brickwork, etc. This is particularly true of boilers with horizontal tubes or those which have only a slight rise of the tubes. The dust naturally collects on the top of the tubes, reducing the efficiency of the boilers.

With a number of our standard water-tube boilers automatic stokers and various types of mechanical grates have been installed burning low-grade fuel. Most of these are fairly successful where the coal is not so small that it drops through the bars. There is always, however, the difficulty of introducing the proper amount of air to secure a perfect combustion and the further difficulty of even distribution of heat and continuous steady generation of steam.

The following are the main difficulties encountered in using pulverized coal blown into the firebox: Maintaining a steady flame, for which is required a high temperature in the furnace; proper furnace lining to withstand the high heat necessary to maintain constant ignition; the difficulty of introducing into the furnace steadily an even mixture of combustible material when the grade of coal varies and when, as is often the case, it is mixed with clinker or other refuse; maintaining this mixture in a satisfactory condition so that valuable matter is not rejected into the stack, as the larger particles are apt to move in a tangent (this difficulty may be overcome to some extent by careful grinding of the coal); handling of the slag which results from the burning of refuse.

In the *Electrical World* of Feb. 1, 1913, page 240, there was shown an installation of boilers using powdered fuel,

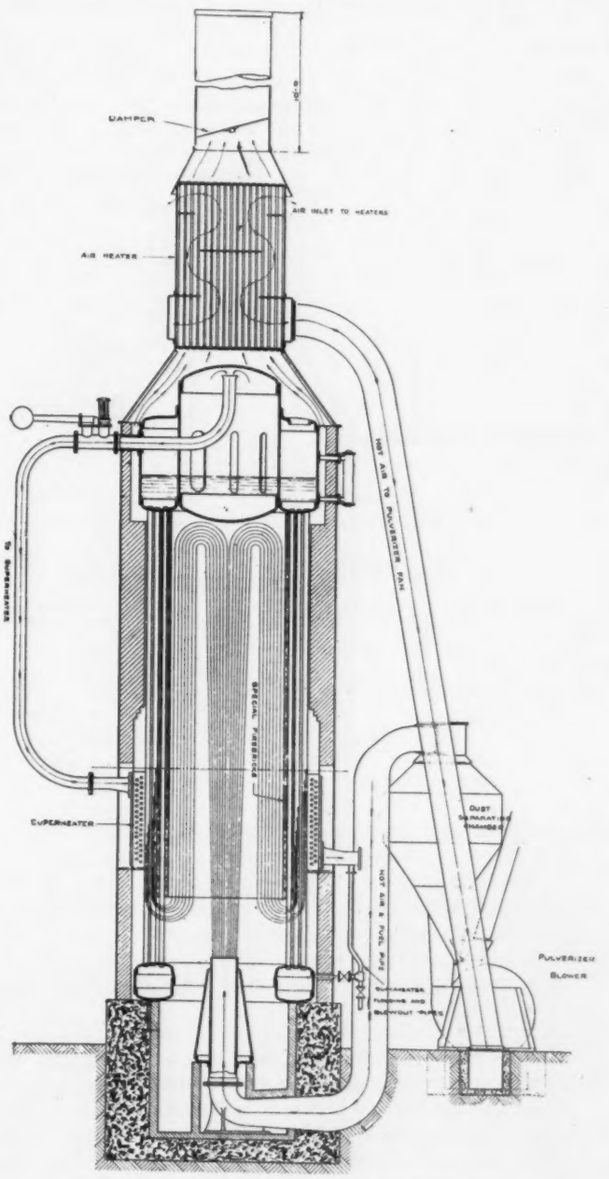


FIG. I—PATH OF GASES IN BOILER

and a description of this equipment will indicate how in actual practice a number of the difficulties are overcome. The principal idea consists in the use of a vertical gas-jet inlet so that a mushroom-shaped flame is produced within a closed ring of vertical boiler tubes which constitute the steam-producing plant.

The heating up and continuous ignition of the incoming stream of dust and air is effected primarily by the enveloping sheath of products of combustion, now a true gas, or, rather, a mixture of gases (principally CO_2, H_2O and N), and at a temperature of about 3000 deg. Fahr. Obviously, this "self-igniter" can never change its predeter-

mined position, no matter how great a velocity is given to the incoming stream of combustible mixture. Ignition is now independent of the incandescent brickwork, which hitherto was in turn dependent upon its proximity to the point of explosion for incandescence.

It is a demonstrated fact that the point of explosion does not rise more than about 10 per cent under the highest feed

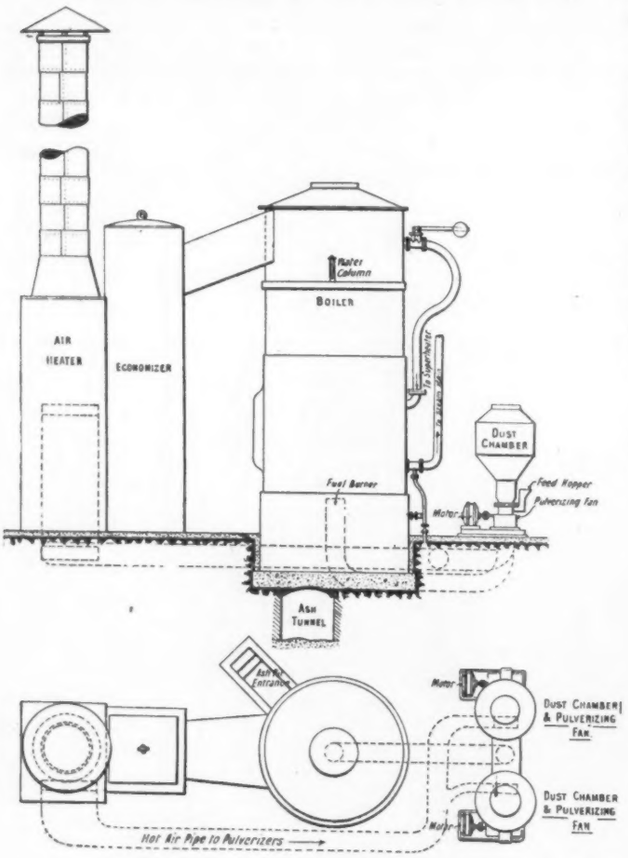


FIG. 2—GENERAL ARRANGEMENT OF UNITS

pressure which it is practicable to employ. The tendency is, for reasons which will be explained later, for the enveloping gases to increase slightly in temperature as the pressure is increased. At the same time these returning gases always insure incandescent brickwork around the tuyère. This has the advantage of storing heat which is sufficient after a temporary stop to re-start the fire by merely turning on the fuel supply.

Owing to the direction of the flow of coal and air, a continuous mixture is secured, thereby overcoming the difficulties mentioned above. The most important mixing of coaldust and air is done before it is blown into the furnace. The solid portion is by weight about one-eleventh of the mixture, and experience seems to show that the coaldust enters the chamber at the same speed as the accompanying air.

The ash is converted into a liquid which is deposited on the brick lining of the furnace, subsequently dropping into the ash pit. The result is that the furnace automatically keeps clear of slag. The spray protects the furnace lining, thus rendering unnecessary the use of fireclay. The firebricks are stacked in position, and after a short time there is obtained a proper lining having a glazed appearance.

Referring to Fig. 1, it will be noted that ignition takes place shortly after the gas enters the furnace. It rises until it strikes the top and turns downward again when combustion has practically ceased. The products of combustion form a sort of sheath or gas lining which prevents blow-pipe action but does not prevent radiant heat passing through to the boiler proper. This boiler can be fired with oil, waste gases or with a mixture of various components.

The coal is fed into a hopper near the pulverizer and is carried by a worm to a chute which leads into the pulverizer proper. The latter is equipped with a blower which delivers the dust into a separating chamber, the smallest particles going directly to the boiler, the larger particles returning to be re-ground (Fig. 2). The gases which leave the boiler pass through an air heater to pre-heat the air for the blower. The pulverizer is generally driven by a directly connected motor. The boiler is first fired by placing a lighted torch at the mouth of the nozzle. After the boiler has once been heated up, however, the gas takes fire from the hot brickwork. It is easy to regulate the supply of air and to secure practically perfect combustion. The boiler is, of course, specially constructed for the work to be done, particular attention being paid to the top header and the brickwork. As the circulation is naturally rapid in this kind of boiler, scale deposit is much less than in ordinary water-tube boilers. With this class of fuel a very small stack is required. Steam can be raised very quickly, and this system can therefore be used to advantage in electric railway power plants and central stations to take care of peak loads. The amount of fuel consumed is, of course, directly proportional to the work done, and the feed can be throttled down or stopped exactly in accordance with the demands of the service. The coal flow is controlled by a lever or cone pulley.

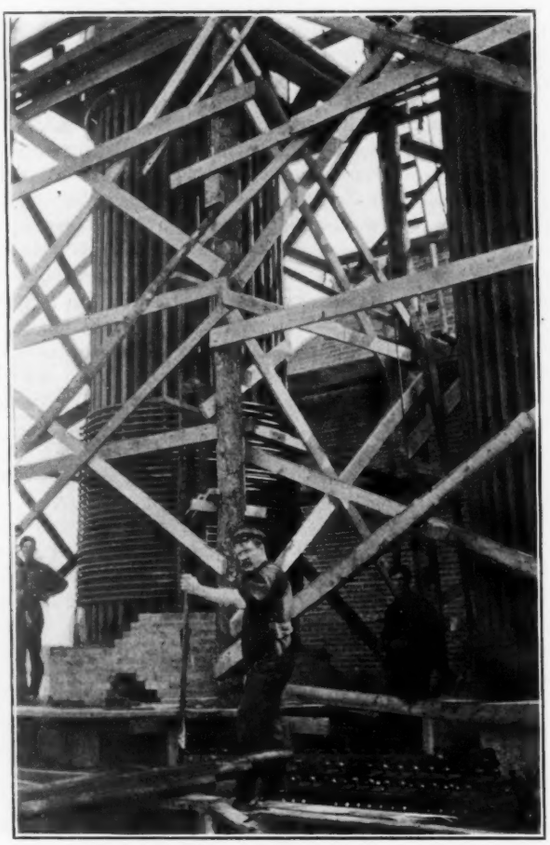


FIG. 3—ARRANGEMENT OF SUPERHEATER WITH BETTINGTON BOILER

In using powdered fuel it is possible to obtain an evaporation of from 6 lb. to 7⅓ lb. of water per pound of coal, or a thermal efficiency of from 75 to 80, depending upon conditions.

A test of pulverized fuel with a similar equipment was given in the *Proceedings* of the Institute of Mining Engineers of England, Vol. 43, Part II, February, 1912, which

shows that dust fuel lends itself to high thermal efficiency, smoke consumption, quick steaming, flexibility, small ground space, unbanked fires, low radiation loss, and the possible use of low-grade fuel. This is borne out by other test figures shown below:

TEST ON BOILER USING PULVERIZED FUEL

Test	1	2	3	4
Duration of test in minutes	145.5	117	51.5	65.5
Absolute steam pressure in pounds	187	189	189	189
Steam temperature in deg. Fahr.	513	515	513	517
Temperature of feed water in deg. Fahr.	74	77	76	78
CO^2 in flue gases in per cent	14.5	17.6	18.7	16.4
Factor of evaporation	1,266	1,265	1,265	1,265
Consumption of coal in pounds per hour	2,775	3,676	3,980	3,372
Water evaporated per hour (actual), lb.	20,100	26,890	28,470	25,300
Water evaporated from and at 212 deg. Fahr.	25,430	34,000	36,000	32,000
Water per pound of coal (actual)	7.24	7.32	7.15	7.50
Water per pound of coal from and at 212 deg. Fahr.	9.16	9.27	9.05	9.50
Heat value of coal by calorimeter	11.50	11.50	11.50	11.50
Efficiency, net, in per cent	79.7	80.6	78.7	82.6

The cost of operation and repairs of the pulverizer has been figured at about 5 cents per ton of coal burned, depending, of course, upon conditions.

Magnetism and Elasticity

By F. J. KEAN

In every dynamo-electric machine there is at least one portion of the magnetic circuit which is subjected to tensile stress by reason of the fact that it is being whirled round at a very high velocity. There are in consequence two distinct problems to consider regarding the behavior of the material which constitutes the rotating element: (1) How does the tensile stress affect the permeability of the magnetic circuit? (2) How does the magnetic force and magnetization affect the mechanical properties of the material?

The effect of tensile stress upon the permeability of the ferro-magnetic materials has been very carefully investigated by such eminent scientists as Kelvin, Ewing and others. The effect of magnetization upon elasticity has also been very carefully investigated, but this effect being of a much more complex nature has not up to the present been really satisfactorily determined.

TABLE I—LOAD AND STRAIN READINGS FROM A MAGNETIZED BAR

Specimen of Annealed Wrought Iron ¾ In. in Diameter	Value of E* in the Virgin Material (Lb. per Sq.In.)	Value of E When Strongly Magnetized (Lb. per Sq.In.)	Percentage Change in E
No. 1	28.28×10^6	28.96×10^6	2.4
No. 2	28.28×10^6	29.20×10^6	3.1
No. 3	28.50×10^6	28.73×10^6	0.8

*E stands for Young's modulus of elasticity.

The practical application of the above problem presents itself to the mind of the writer very emphatically in the case of a salient-pole revolving-field alternator of the type sketched in Fig. 1. Here we have the poles of the magnet traversed by lines of magnetic flux which pass through them radially, while at the same time the material is subjected to direct tensile stress which also acts radially owing to centrifugal force.

To obtain some preliminary idea of what is likely to happen it seems fair to compare the case to that of an electromagnet and its keeper by imagining a section taken through one of the poles and forming a perfect magnetic joint at the surfaces (Fig. 2). Let H be the magnetic force in c.g.s. units, I the intensity of magnetization and B the induction density in lines per square centimeter. Then any pull applied to the pole would result in separating the two parts of the joint in preference to extending the material of the pole. If this be allowed, and if we agree that when a load is applied to a bar the bar becomes strained and extends itself until the stress set up in the material balances the applied load, it seems fair to assume that in the case of a magnetized bar the applied load will expend itself in overcoming the magnetic pull before it commences to strain the bar and the real stress necessary to balance an applied load will be less than the nominal strees by the stress equivalent to the magnetic pull.

Experiments to determine the amount of strain due to magnetization were first made by Joule[1], and later by Mayer[2] and Barrett[3], but the most important were those of Bidwell[4], who found that iron became lengthened by magnetization in a moderate field but shortened when magnetized in a very strong field. The strain caused by magnetization with moderate forces was an extension varying from $\frac{I}{200,000}$ to $\frac{I}{400,000}$ of the length; with very large magnetic forces a contraction of length was observed amounting to $\frac{I}{150,000}$. When the material was magnetized while a load was hanging from it the strain caused by magnetization was different from that of the unloaded specimen. The extension was much less and finally disappeared with big loads, the strain being one of contraction even in the weakest fields, and this contraction increased as the load was increased.

TABLE II—ELASTICITY OF MAGNETIZED BARS

Load	Strain	Load	Strain
0	0	5000	370
1000	60	6000	450
2000	140	7000	530
3000	220	8000	610
4000	300	9000	690

Experiments to determine the effect of magnetization upon the modulus of elasticity (E) of the material were first made in 1842 by Wertheim[5], in 1848 by Wartman[6], and in 1886 by Tomlinson[7], each of whom found no change in the modulus of elasticity due to magnetization. Later Brackett[8] in 1897, Stevens[9] in 1899, and Tangl[10] in 1900 each found an increase in the modulus due to magnetization. In summing up, however, Tangl says that the effect of magnetization upon Young's modulus depends greatly upon the previous history of the material as regards stretching. Then in 1902 Honda[11] and others investigated similar phenomena, obtaining conflicting results in the case of steel bars subjected to magnetization, and later still Rensing[12] found that a decrease of elasticity took place under magnetization.

It was evident to the writer when he undertook the investigation herein described that extreme care and accuracy would be required. Moreover, it seemed necessary to be very precise in defining the method of determining the modulus as well as in the exact procedure to which the bars

[1] *Phil. Mag.*, Vol. xxx.
[2] *Phil Mag.*, Vol. xlvi.
[3] *Nature*, Vol. xxvi.
[4] *Proc. Roy. Soc.*, Vol. xl.
[5] *Ann. de Chem. et de Phys.*, (3), Vol. xii, page 60.
[6] *Ann. de Chem. et de Phys.*, Vol. xxiv, page 360.
[7] *Proc. Roy. Soc.*, Vol. xl, page 447.
[8] *Phil. Mag.*
[9] *Phys. Res.*, (2), Vol. ix, page 116; (2), Vol. xi, page 95.
[10] *Ann. de Phys.*, Vol. vi, page 34.
[11] *Ann. de Phys.*, June, 1904.
[12] *Phil. Mag.*, (6), Vol. iv, page 459.

should be subjected throughout in order to make the results comparable. The method of magnetization had to be decided upon, and for this purpose a yoke of soft iron in the form of a channel section was chosen with all the coils wound on the yoke itself and the bar under test left quite free. The bar to be experimented upon was placed in effect across the channel and passed through two nicely fitting

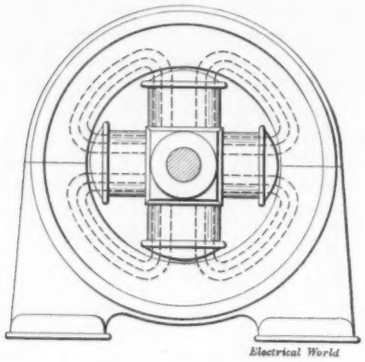


FIG. 1—PATHS OF MAGNETIC FLUX IN DYNAMO

holes without binding in any way on the sides of the holes, and the portions of the bar extending beyond the yoke served for the grips. A free length of 11 in. was available for the measuring gear on the portion of the bar inside the yoke, the bar being 0.75 in. in diameter.

In the tests about to be described the bars were of best Yorkshire iron very carefully annealed by the Farnley Iron Company and turned and ground up true to within one one-thousandth of an inch.

The measuring gear used was the Goodman extensometer, and the tests were made by the writer in the Mechanical Engineering Laboratory at Leeds University, England. To avoid temperature effects the magnetizing coils, as stated above, were kept on the yoke only and no readings were accepted which gave any indication of a temperature change. The magnetizing force used was approximately 40 c.g.s. units, and this gave an induction density in the

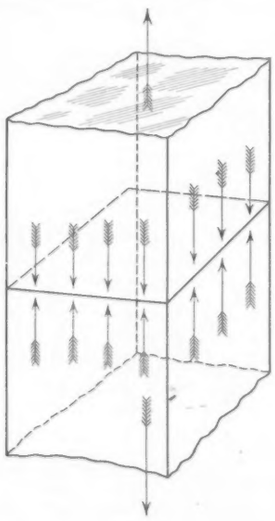


FIG. 2—PERFECT MAGNETIC JOINT

bar itself of about 12,000 lines per square centimeter—a very exact determination was not considered essential for these quantities. In defining the quantity known as Young's modulus of elasticity the writer makes the assumption that a material is elastic if the strain entirely disappears when the load which produced it is removed; that an elastic material obeys Hook's law, which is in effect that "Stress is proportional to strain" within the limits of elasticity, and that the ratio of stress to strain is constant for the elastic state of the material, the quotient being termed Young's modulus of elasticity. The modulus was determined by direct pull and measuring the strain corresponding to equal increments of load which amounted to 1000 lb. at a time.

In Table I is shown a set of readings taken from one of the magnetized bars. It will be noted that with the exception of the first reading the increment of strain for any given increment of load does not differ very greatly throughout the set. Care must be exercised with regard to the calculation of the modulus of elasticity. Two methods are available: (1) To draw a stress-strain diagram and measure the slope of the elastic line; (2) to calculate the average strain set up by a given amount of load applied, using the "method of differences."

When the bar is in the unmagnetized state and not subjected to any magnetic force other than the vertical component of the earth's field one would expect the elastic line to pass through the origin as shown in Fig. 3, but when a large magnetic force is applied and the bar becomes strongly magnetized it would be expected from Bidwell's researches that the elastic line would run parallel to the previous one but displaced from it by a distance equal to the strain that corresponds to the stress induced in the material by magnetization. If any change occurred in the value of

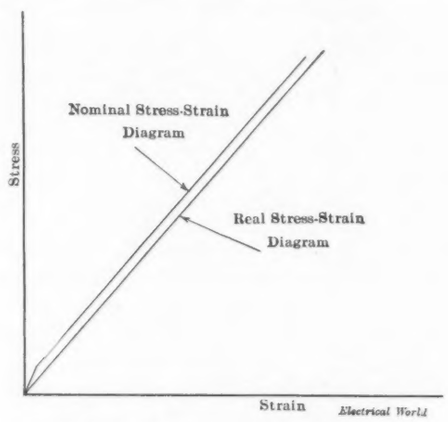


FIG. 3—STRESS-STRAIN DIAGRAMS

the modulus of elasticity, the new elastic line would not run parallel to the old one.

One difficulty that the writer experienced, in common with previous investigators, was that the behavior of the bar after it has once been tested in a strong magnetic field is not the same as its behavior when taken in the virgin state and magnetized strongly for the first time; therefore, instead of attempting to repeat experiments on the same bar by demagnetizing it, he used three different bars of the same material all in the virgin state and examined their behavior when subjected to a very strong field for the first time, and in preference to relying on the graphical method of finding the modulus of elasticity he used the "method of differences" but ignored entirely in each case the first extensometer reading and found the average strain per increment of load from the remaining readings both in the unmagnetized and the magnetized state.

The results which were obtained by him from these experiments are given in Table II, from which it is clear that magnetization increases the elasticity of the bar by an average of about 2 per cent, but the exact amount of the increase varies very considerably for similar bars of the same material. Further experiments were made to ascertain the behavior of the material when the magnetic force was withdrawn entirely and again reapplied, but these are not yet complete.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Routing Out Competitive Illuminants at Nashville

During last month the contract department of the Nashville Railway & Light Company, Nashville, Tenn., secured orders for fifty-three house-wiring jobs, each one of which covered an already-built dwelling in which no wiring had previously been installed. Through the department ninety-nine flatirons were placed, fifty gas arcs and four gasoline plants were displaced by electric lighting, and orders were taken for fifty 250-watt tungsten-lamp units.

Transformer Truck for Emergency Connections

The Crawfordsville (Ind.) Electric Light & Power Company has equipped a truck with a pair of 25-kw transformers for emergency use. In case of transformer breakdowns, this truck can be dispatched to the scene of the trouble and connected up to render service until repairs are made or a new transformer is installed. The terminals on the portable set are so arranged that 220-volt, three-phase service can be supplied to motors, or the coils can be connected in multiple to deliver temporary 110-volt energy to lighting circuits used for street fairs, circuses, tent shows, etc. The truck equipment can also be utilized for thawing out frozen water pipes.

An Electric Eastertide Exhibition

A Cyphers incubator containing ten dozen Plymouth Rock eggs of first quality, which are being hatched by electricity, is now on exhibit in the show window of the Kentucky Electric Company, Louisville. The appearance of the young Plymouth Rocks is expected at Eastertide, the process of incubation having been commenced Feb. 27. Meanwhile the company is educating all persons interested in the modern way of producing poultry. A minute record is kept of the number of times the eggs are turned every twenty-four hours, the extent to which they are cooled and the general care taken, while a meter on the incubator registers the consumption of energy so that inquirers may be informed of the actual cost of producing a batch of chickens. The experiment, suitably advertised, is attracting widespread attention.

Combination Room and Meter Rate at Pittsburgh

The Duquesne Light Company, of Pittsburgh, Pa., a subsidiary of the Allegheny County Light Company, announces a new combined "room" and meter rate for electric service. Present customers may avail themselves of this schedule by making applications for new contracts. The new rate is explained as a step to improve the load-factor on the company's plants, giving customers a better rate for off-peak consumption.

The new schedule combines a flat-rate charge, based on the rooms served, with a kilowatt-hour charge proportional to the energy consumed. For each downstairs room in residences a base rate of 15 cents per month will be charged, with a similar rate for each downstairs hall. Upstairs rooms will be charged at the rate of 5 cents per month, with no charges for bathrooms and upstairs halls. For purposes of billing apartments are to be regarded as downstairs throughout. The minimum monthly charge fixed is 65 cents. Where more than fifty lamp sockets are installed these will be charged for at the rate of 2 cents per additional socket.

In addition to the flat-rate fixed charges above outlined, the energy consumed will be measured by meter and charged for at the rate of 6 cents per kw-hr., with a reduction of 1 cent per kw-hr. if bills are paid within ten days. The former rate of the company was 12 cents per kw-hr., with a 2-cent reduction for prompt payment.

Wichita Dye Works Using 3000 Kw-hr. Monthly

The cleaning and dyeing establishment of Mr. J. S. Giwosky, at Wichita, Kan., is equipped with fifty electric irons and half a dozen motors, consuming each month from 2500 to 3000 kw-hr. of central-station energy. The majority of the irons are of the 6-in. size and lighter, used for

CLEANING ESTABLISHMENT AT WICHITA, KAN., USING FIFTY ELECTRIC IRONS

pressing delicate fabrics, although the men's clothes department employs fifteen 18-lb. irons. Three centrifugal extractors, five washing machines and one steam-heated tumbler or drier are all driven by a single 15-hp motor. Another extractor has a separate 2-hp motor, and there is a 5-hp elevator motor. Based on its connected load, the cleaning plant guarantees the Kansas Gas & Electric Company a minimum bill of $75 monthly.

"Only Way to Make Small-Town Plant Pay"

"The only way to make an electric-light plant pay in a small town is to operate in connection with it a combination ice factory," declares the manager of a successful ice-electric property in a North Texas town of 1200 population.

This man has a 4-ton plant which he operates six months in the year, manufacturing a total of about 700 tons of ice for the local population. His ice equipment represents an investment of about $5,000. In addition to the refrigerating machinery, ice is stored in a small vault capable of holding about 6 tons, or nearly two average days' output.

Following is his itemized statement of his monthly oper-

ating expenses: Fuel, $300; labor (including office help), $100; supplies, miscellaneous, $25; delivery, $30.

The actual plant cost to produce one ton of ice on the station platform he estimates at $3.50. This product is sold at wholesale for $8 per ton, while the local domestic price for delivered ice is 50 cents per 100 lb.

The balance sheet for a year's operation gives the following general figures: Yearly gross income from ice business, $5,400; yearly expenses (depreciation, interest, etc.), $2,520; net income from ice business, $2,880.

With an investment of $5,000 this plant is therefore earning about 56 per cent net returns on the original outlay, making a welcome addition to the meager income which an electric plant alone would produce in a community of 1200 population.

Ice-Electric Operation with Water Pumping

Electric generation, ice making and water pumping should be held up before the small-plant operator as the trinity of maximum economy toward which his efforts should be bent. One such triple-combination station in latitude 40 deg. near the Mississippi River has a 10-ton ice machine which produces 600 tons during its six-month ice-making season. Approximately $10,000 is invested in the ice department, which returns a gross income of $3,300. The domestic price for delivered ice is 45 cents per 100 lb. and for wholesale quantities $4 per ton. The management expresses itself as well pleased with its success in ice-making, reporting combination operation thoroughly satisfactory in connection with its other departments. The population served numbers 2000.

"Combination Ice Plants a No. 1 Investment"

"Combination ice-electric plants in good localities having suitable shipping facilities are No. 1 investments and beat the business of producing and selling electricity in several ways," to quote a Southwestern operator who has a 10-ton plant in a town of 1300.

But, pointing to his own case as a gentle lesson, this manager warns against installing an equipment too large for the local ice consumption. A 5-ton plant in a town having a market for 5 tons daily is a better investment, he points out, than a 20-ton outfit in a larger community where by reason of restricted demand or outside importation only a fraction of the ice-making capacity is used. Near certain centers large city manufacturers seeking to find markets for their surplus capacity are crowding the small local factories, since the big plants can sell at a rate even less than the production costs incident to ice making on a small scale.

In this Oklahoma 10-ton plant the investment represented by ice machinery and building is about $10,500, to which must be added $600 for wagons and teams. There is also storage capacity for 300 tons of ice, an additional outlay of $1,000. The total investment thus reaches $12,100.

Coal to operate the ice plant costs $1.90 per ton, making the fuel expense average $9.50 per day. Various labor items about the plant, including office assistance, etc., total $17.50.

The plant produces 2000 tons a year, all of which is made during its six-month season. The actual cost of manufacturing a ton of ice is estimated at $1.30. The wholesale price is $3.50 per ton. For the domestic supply, delivered to the customer's premises, the local price is 60 cents per 100 lb.

Following is the summary of a year's business: Annual gross income from ice-making, $3,500; yearly expenses, $2,500; net return from ice-making, $1,000.

The operator above quoted is, however, thoroughly pleased with combination operation, and to any company contemplating putting in ice machinery he offers the pointed advice, "Get busy," provided, he adds, the locality affords a good market for the congealed product. His own plant gives an example of the double service secured from station attendants under combination operating conditions. The engineer here, as in other small ice-electric plants, operates the ice machinery without any hindrance to his regular duties.

Ice Business Has No Bad Accounts

In comparing the ice-making and central-station departments of their business several combination-plant operators comment particularly on the freedom from bad debts enjoyed by the ice business. Especially is this the case if the retail sales are handled with coupons, books being sold for cash. Ten per cent discount may even be allowed for payment in advance.

"But be sure to use ice tickets in your deliveries," urges one operator, adding the sharp instruction which he gives to his own drivers, "No ticket, no ice!"

Tickets save disputed bills and misunderstandings with customers, especially with the women. "In the ice and light business," declares one man with experience, "the women are worse to deal with than the men. They are disposed to dispute all bills on general principles; they will not take the trouble to inform themselves and will not listen to an explanation. The only objection to the retail business is the female element. If you deliver your own ice, be careful to give full weight and avoid business dealings with the women!"

"Retail all ice by pound coupon books" is the pointed advice which another manager offers. As long as this policy of advance payment is adhered to, however, the dealer may be assured that he will be embarrassed by none of those overdue accounts which too often are the bane of the central-station manager in the small community.

Commercial Club's Electric Luncheons

The members of the Commercial Club of Corvallis, Ore., which holds weekly noonday luncheon meetings, now enjoy appetizing dishes prepared with the aid of an electric stove loaned to the club by Manager Morton of the Oregon Power Company. The Commercial Club has several other electric appliances so that it is able to handle the preparation of its luncheons with dispatch. This use of electric cooking has proved a great advertisement for the local central-station company. The club members are well pleased with electric service and may purchase the entire outfit.

Minimizing Unnecessary Meter Removals at Des Moines

It is an axiom among real-estate men that an electric-lighted dwelling does not remain long without a tenant. A corollary to this proposition almost too apparent to need formal statement is found in the fact that no sooner does the electric-light company remove its meter at the behest of a departing tenant than it is required to replace its service in the same premises to meet the demand of the incoming renter.

An effort to obviate the expense and labor of needlessly changing meters back and forth is being made by the Des Moines (Iowa) Electric Light Company, which uses the service-discontinuance card reproduced herewith. When an outgoing customer sends instructions to discontinue his service every effort is at once made to find out the name and present address of his successor. Sometimes this information can be obtained from the old tenant, and usually always from the landlord or his agent. The data, together with the presumptive dates at which service is to

be discontinued and is likely to be needed by the new tenant, are entered on the card. On the day the old occupant moves an inspector is dispatched to the house to read the meter and remove the service cut-out fuses. He also leaves a tag in some prominent location in the house, notifying the next comer that the building is wired for electric light and the electric service is available on order from the company.

The bottom coupon of the card is then filled out for the auditor, stating the final meter reading, from which the departing customer's last bill is to be computed. The next tag is addressed to the general foreman, advising him of the discontinuance of service and removal of fuses. Another card is provided to be mailed or delivered to the prospective new tenant at his present address, explaining how service can be restored on order. Attention is called to the Des Moines central-station synonym, "the public-be-pleased company," which is used locally with good effect. Another tag is available for instructions to the general foreman when the new service has been reconnected and the fuses replaced.

Des Moines Electric Co. .....191...

Customer's instructions to discontinue service

Name .....

Address .....

Customer gives notice that service is to be discontinued by.....191...

Present customer says premises will.....be occupied by another party by (date).....191.....

Name of prospective occupant is.....

Prospective occupant can be found at.....

Name of owner or agent of premises who will have key when present occupant vacates.....Address.....

.....

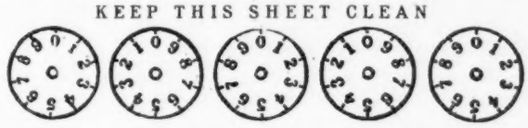
Signature of employee taking instructions.

Inspector: Please fill in blank spaces above if not already filled in. If occupant does not move out on date of your first visit obtain foregoing information only, but give exact date occupant will move.....191....

If occupant moves out on the date of your visit, read meter, remove fuses and tie tag in conspicious place. Fuses turned in to.....

Where did you tie tag?.....

KEEP THIS SHEET CLEAN



Reading.....Constant.....Our number on meter.....

(date).....191.....Inspector

General Foreman: Please be advised that fuses controlling service through meter No.....at (address).....for new occupant (name).....have this day been put in. Former occupant was (name).....

(date).....191.....Chief Clerk

Des Moines Electric Co. Des Moines, Iowa.....191...

To.....(address).....City

.....The former occupant of premises (address)

.....instructed us to discontinue our electric service.

When you are ready to have the electric service re-connected be good enough to call at our office to sign application when service will be furnished.

Very respectfully,

DES MOINES ELECTRIC CO., 8th and Locust Sts.

the "Public be pleased" Company

General Foreman: Please be advised that fuses controlling service through meter No.....for (name).....at (address).....have this day been taken out on account of occupant vacating premises.

(date).....191.....Chief Clerk

Auditor: Please be advised that service to (name).....at (address).....through meter No.....has this day been disconnected on account of occupant vacating premises. Meter reading is.....

(date).....191.....Chief Clerk

METER-TRANSFER CARD USED IN DES MOINES, IA.

The present system was devised with special respect to the large number of meter transfers which ordinarily occur in Des Moines on the proverbial semi-annual moving days. With several hundred meters to be removed and afterward restored to the same locations much unnecessary labor was involved, and some delay resulted to inconvenience customers waiting for service. The present plan provides that no meter shall be removed as long as it is likely to be needed in its present position, and as already stated, electrically equipped houses are at too great a premium to go very long begging for occupants.

Local Ice Factory as Summer Customer of District-Heating Plant

If the central-station company in the small town prefers not to go into the ice-making business itself, it can sometimes find a profitable disposition for some of its plant by-products by selling steam and distilled water to the local ice factory.

A Middle West electric company, which does a district-heating business in winter, sells steam during the summer to operate the ammonia compressor in the adjoining ice plant, receiving for this steam 30 cents per ton of ice manufactured. For the ice factory's water supply the central station charges 3 cents per 1000 gal., under the condition that the condensing water be returned to the reservoir. The water used for ice making it also sells to the factory at the rate of 7 cents per 1000 gal.

Capturing a Difficult Power Installation

The following account of the particulars of a motor-service sales problem was recently posted on the sales department bulletin board of the Boston Edison company, showing the general line of attack on an unusually difficult proposition:

"Among the company's present customers is a small factory operating light-running machinery. It formerly had a 50-hp high-speed engine and employed one engineer to do the firing and general repair work around the shop. On receipt of our report previous to the shutting down of the plant the proprietor was so far influenced by our estimate that by the use of electric service a saving of $800 could be made on his total cost of $1,600 that he employed a prominent consulting engineer to advise him. The consulting engineer had several tests made on the engine and submitted a complete report advising against electric power, showing a net loss of $300 per year, estimating that the cost of electric power would be $1,092. We have a copy of his report on file.

"The proprietor, however, finally followed the central station's suggestion and on its recommendation one 10-hp motor was installed, the company relying on the overload capacity of the motor to handle a freight elevator that operates through the height of one floor. A police valve was put on the boiler, holding the pressure at 15 lb., and the heating of the building is now handled by the shipper, who receives a small additional salary. The engineer has been dispensed with altogether as it was found that his services outside the operation of the steam plant were practically valueless. The actual bills for electric power for one year have been $555, or about the same as the former coal bill, and the proprietor estimates that his saving, taking everything into consideration, is about $700 a year."

Illumination and Wiring

Large Electric Sign in Milwaukee

What is possibly the largest one-word electric sign in the country has been erected on the roof of the Majestic Building in Milwaukee for Gimbel Brothers, proprietors of a department store. The sign consists of the word "Gimbels" made up of letters 34 ft. high. It contains 2210 10-watt tungsten lamps. The edges and backs of the letters are of black enamel, the body of the letters being formed by 12-in. grooves of white enamel. The letters are supported on a steel frame 160 ft. long and 77 ft. high. They are raised 23 ft. above the level of the roof and the whole sign, framework and all, weighs 18 tons. It is said that this sign can be read from a distance of 25 miles under favorable weather conditions. No flashing device is used, the sign being lighted continuously during the evening. Electricity is furnished by the Commonwealth Power Company. The sign was installed by the Thomas Cusack Company, Milwaukee, of which Mr. Joseph T. Aultman is sales manager.

Improving the Lighting of a Reading Room

The main reading room of the Boston Society of Civil Engineers at 715 Tremont Temple, Boston, Mass., has recently had its illumination remodeled with excellent results. This room is about 40 ft. long by 16 ft. wide and 11 ft. high, and it is at times used for informal lectures. The former lighting was accomplished rather unsatisfactorily by three 4-ft. chandeliers, each of which carried four 16-cp carbon lamps at a height of about 4 ft. above a reading table whose working surface was 32 in. above the floor. These lamps, being only 7 ft. above the floor, were in the way when lantern-slide talks were planned, and the quality of the lighting was also inferior on account of the low total candle-power available.

IMPROVED LIGHTING IN LIBRARY OF CIVIL ENGINEERING SOCIETY, BOSTON

The new installation, shown in part in the accompanying photograph, consists of three fixtures hung from the former outlets and about 10 ft. apart, each carrying four 60-watt tungsten lamps with frosted bottoms set in pear-shaped Carrara translucent shades at each fixture. The lamps are carried about 6.5 ft. above the table, or approximately 9 ft. above the floor, leaving a free space for the use of the stereopticon.

The room is finished in golden oak, the engineering periodicals in the cases being bound generally in black. For a trifling increase in the connected load of from 650 watts to 720 watts the library secures 576 cp, or about 0.9 cp per sq. ft., compared with 192 cp, or 0.3 cp per sq. ft. in the former installation, besides gaining in the quality and distribution of the light.

Decorative Street Lighting at Cedartown, Ga.

When it was decided to put down asphalt pavement on Main Street, Cedartown, Ga., advantage was taken of the opportunity to lay conduit for an underground system of street lighting and distribution. As there were no cross streets to be lighted and the Main Street curbs are spaced 40 ft. apart, it was decided to install the posts at 80-ft. intervals, staggering alternate groups, to give uniform illumination.

The fifty-one three-lamp standards were made by the local foundry. Each top lamp is a 100-watt unit in a 16-in. Alba globe, while the lower lamps are 60-watt tungstens in 12-in. globes. Service is supplied from three transformers located in different sections of the street, thus maintaining a balanced load on the three-phase primary system. The secondary wiring is arranged in the form of three-wire distribution, with lower lamps in series on 220 volts and top lamps operating at 110 volts. Equal numbers are connected on each side of the neutral, thus reducing the size of the middle wire.

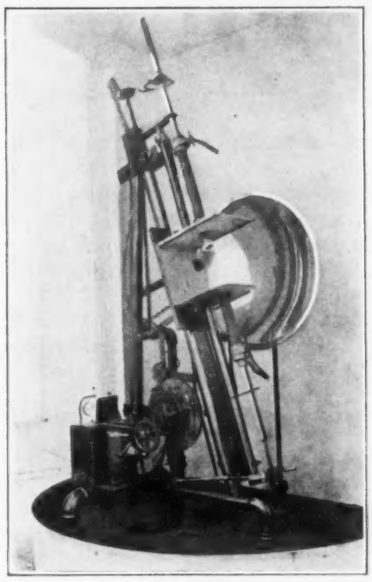
Each post is provided with a three-pole single-branch block, while the feeder posts have two single-pole knife switches arranged to cut out the bottom lamps at 10 p. m. (12 midnight on Saturday). The top lamps burn all night, consuming the same wattage as the series arcs which they displaced. The central post in each circuit is used as the feeding point, from which run the feeders to the transformers located on the intersecting streets. This arrangement permits of a reduction in the size of wire in each run between the posts.

WHITE-WAY LIGHTING INSTALLATION ON MAIN STREET, CEDARTOWN, GA.

The cost of the installation was paid by the property owners on the basis of $0.75 per front foot. Energy to operate the system is included in the street lighting at an additional cost to the city of 1 cent per post per night. The installation was made and is operated by the Cedartown water and light department, of which Mr. W. T. Hardy is superintendent.

A Flashing Electric Fog Lamp

In the ferry service at San Francisco, use is being made of a powerful flashing arc lamp for locating the boat piers in foggy weather. Two motor-driven carbon electrodes, each 1.25 in. in diameter, are periodically brought into contact and then separated, drawing the arc into a long luminous flame which, on reaching its maximum, is blown out by an electromagnet. The period of flash can thus be regulated to designate any particular locality by a prearranged time signal. The beam of light from the new lamp will penetrate very dense fog and is useful even in daylight. The United States Supervising Board of Steamboat Inspectors has authorized the use of the lamp, it is reported, for signal purposes on other vessels besides the ferryboats where it was first employed.

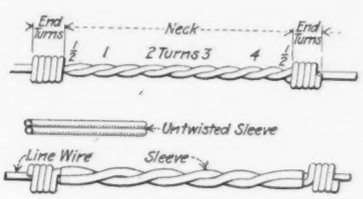


MECHANISM OF FLASHING ELECTRIC FOG SIGNAL

Methods of Splicing Wires and Cables

By H. V. Talbot

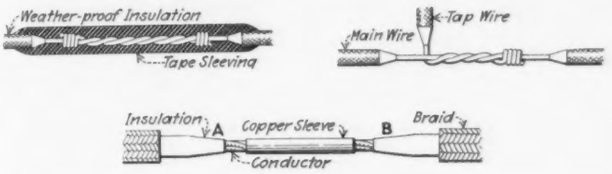
Splices in bare copper line wire can be made as indicated in Fig. 1 and should be mechanically and electrically secure before solder is applied. There should be at least five turns in the neck (Fig. 1) of a splice to insure that the unsoldered splice will be as strong as the wire of which it is made. All splices in wires for conveying electricity should be soldered in the neck. It is not always necessary to solder the end turns. McIntire sleeves are very satisfactory and are used to a great extent for splicing aerial line wires. (See Fig. 2.) Solder is not necessary where sleeves are used.



FIGS. 1 AND 2—CONNECTIONS IN BARE WIRE

For further information in regard to splices in bare wire see an article published in the *Electrical World* for Nov. 17, 1910, entitled "Some Tests on Splices in Galvanized Iron Wire," which was contributed by Mr. C. T. Rashman.

Splices in insulated aerial line wires are made similarly to that shown in Fig. 1, except that tape is served around the splice for insulation. (See Fig. 3.) If the line wire has only weatherproof insulation, friction tape is sufficient, but if the inner insulation is rubber, rubber tape, to the thickness of the inner insulation, should be applied before the friction tape is served.

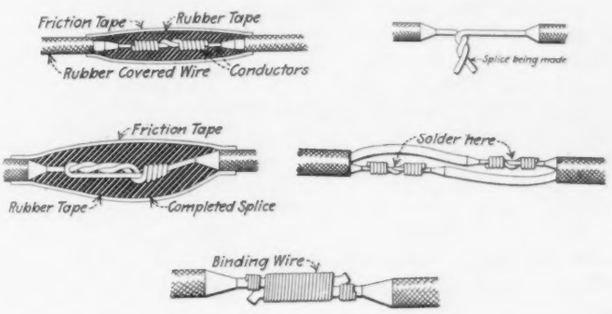


FIGS. 3, 4 AND 5—CONNECTIONS IN WEATHER-PROOF AND RUBBER-COVERED WIRE

In preparing the conductor ends, about 1 in. of each end should be bared and cleaned; then, with a very sharp, thin-bladed knife, the insulation should be beveled for about 1 in. as one would sharpen a lead pencil. The conductor joint should preferably be made with a copper sleeve, sweating the latter on, care being taken to clean off all surplus solder, or if the connection is made by twisting the two ends together, that the ends do not protrude. The bevels and conductor should then be covered with a thin coat of a pure rubber cement, and this should be allowed to "set."

When insulating the joint a strip of ¾-in. pure rubber tape 6 in. to 8 in. long should be wrapped spirally around the joint, beginning at the bevel on a level with the insulation (*A* in Fig. 5) and continuing to the other side of the joint as far as the high point of the bevel (*B* in Fig. 5). The operator should continue to wrap to and fro until the insulation is built up slightly thicker than the regular wall. The tape must be put on under tension—say stretched to about half its width, and care must be taken to have everything perfectly clean.

To vulcanize the joint partially heat may be applied evenly from a spirit lamp, a lighted match or the hand for about one minute. The joint may then be wrapped with two layers of ¾-in. friction tape. If the wire is braided or taped, the braid or tape should be cut well back so that there are no loose threads overhanging to interfere with the proper insulation of the joint. Should the friction tape become slightly set, as it sometimes does in extreme cold weather, a gentle heat will restore it.



FIGS. 6, 7, 8, 9 AND 10—SPLICES IN INTERIOR WIRING

Splices in interior wires are made as shown in Figs. 6, 7, 8, 9 and 10. Not as many turns are necessary in the neck as for aerial line wires, and all splices must be soldered. Rubber tape to the thickness of the rubber insulation must be used on rubber-covered wires and friction tape must be served over the rubber to hold it in place. The so-called "fixture splice" (Figs. 7 and 8) is used

largely by telephone men and in wiring fixtures. It can be conveniently used sometimes in splicing two wires that must be drawn taut in the splicing. A splice in wires is often made at a point between two supports (cleats or knobs) in this way. The duplex wire splice (Fig. 9) is often used by telephone men. The joints should always be "broken"; that is, they should not be opposite each other.

FIGS. 11, 12, 13 AND 14—METHODS OF MAKING TAPS OFF MAIN-LINE WIRE

In conduit work where duplex wire is frequently used joints are not permitted by the National Electrical Code except in junction boxes, but nevertheless they are occasionally made as indicated and pulled into the conduit. Rubber and friction tape are applied to each in the same way as to the joint in a single wire, and then the pair of wires should be served with friction tape. Joints should always be taped so that the insulation over the joint equals that over the rest of the conductor.

Taps in interior wires are made as shown in Figs. 11 and 13. The "knotted" tap has the advantage that the tap wire cannot untwist from the main wire. Tape should be applied as in the case of splices. The tap for small aerial wires (Fig. 4) is made by giving the tap wire one long complete wrap around the main wire and then four short turns. Taps for larger aerial wires can be made as suggested in Fig. 12. The long wrap gives the joint a certain amount of flexibility which is necessary for aerial work where the wires are moved by the wind. The tap for very large wires (Fig. 14) is made by serving a binding wire about bared portions of the tap and main wires and then soldering the whole.

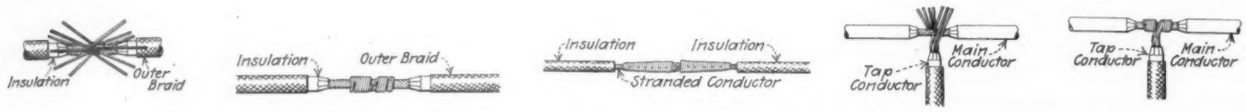
Joints in cables are made as shown in Figs. 15, 16 and 17. The wires composing the cable should be spread and each pulled out straight and the core or a few inner wires cut away so that the splice will not be bulky. Then the two cable ends should be abutted as shown in Fig. 15, and the wires interwoven in groups of two each and served along the cable. The joint is soldered by pouring, with a ladle, molten solder through and over it. For interior work a short joint like that of Fig. 16 is frequently used, but in aerial work a longer one, like that of Fig. 17, is preferred. For an aerial joint (Fig. 17) a length of about 16 in. to 20 in. is bared at the end of each cable in order to make a splice.

Taps in cables are made as suggested in Figs. 18, 19 and 20. Fig. 18 shows how the tap wires are "fanned" out before being served about the main conductor, and Fig. 19 shows a completed tap joint for interior work. Fig. 20 shows a completed tap joint in an aerial cable. Tap joints in cables can be made with a binding wire similarly to the method of Fig. 14. When a joint like that of either Fig. 19 or Fig. 20 is made the entire core or some wires should be cut from the center of cable so that the joint will not be bulky.

In making any joint the wire ends should be scraped bright with the back of a knife blade, sandpaper or emery paper, so that the solder will adhere readily. Insulation should be cut away as shown at *B* (Fig. 21) rather than as shown at *A*. When cut as at *A* the wire is likely to be nicked and with the *B* method the tape can be served more neatly about the joint. The outer braid should be cut well back from the joint so that stray strands from it cannot be taped into the joint and, by capillary attraction, conduct moisture thereto.

For soldering joints a non-corrosive fluid is recommended; solutions made with acids should be avoided. The commercial soldering pastes and sticks give good satisfaction in cleaning joints to be soldered. Joints in small wires are best soldered with a soldering copper, and burning of the insulation is thereby avoided. An alcohol or a gasoline torch should be used on medium-sized joints, while on the larger ones it is most convenient to employ a solder pot and ladle.

A soldering flux removes and prevents the formation of an oxide during the operation of soldering, so that the solder will flow readily and unite firmly the members to be joined. For copper wires the following solution is recommended by the Underwriters: Saturated solution of zinc chloride, five parts; alcohol, four parts, and glycerine, one part.

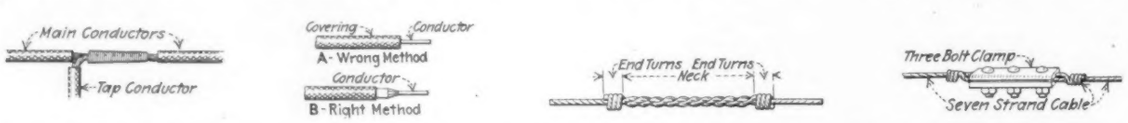


FIGS. 15, 16, 17, 18 AND 19—METHODS OF MAKING SPLICES AND TAPS IN STRANDED CONDUCTORS

Soldering paste or stick can be made as follows: Melt 1 lb. of tallow and add 1 lb. of common olive oil; stir in 8 oz. of powdered rosin; let this boil up and when partially cool add, stirring constantly, ¼ pint of water that has been saturated with powdered sal ammoniac. Stir the mixture constantly until cool. By adding more rosin it can be cast into sticks.

Galvanized iron or steel wires are spliced as shown in Fig. 1, and five turns are necessary in the neck of the splice to insure that the splice shall be as strong as the wire. The strength of an unsoldered joint is determined by the number of turns in the neck, the end turns having but little holding power.

Small galvanized steel cables are joined in the same way as are wires, as shown in Fig. 22. There should be five turns in the neck, as with wires, and a few end turns to finish off the joint. Soldering is unnecessary for guy wires. Larger cables can be spliced as shown in Figs. 15 and 17, or mechanical clamps can be used instead, as shown in Fig. 23. Sometimes it is necessary to use several clamps, instead of one, as the figure shows, in order that the joint may be as strong as the wire.



FIGS. 20, 21, 22 AND 23—JOINTS IN HEAVY CONDUCTORS AND STEEL CABLES—METHODS OF REMOVING INSULATION

Recent Telephone Patents

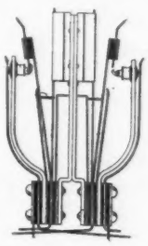
SENDERS FOR AUTOMATIC SYSTEMS

Mr. C. A. Bals, of Chicago, is the inventor of an improved type of the sending device for an automatic system. The feature of this invention lies in so constructing and mounting the sender in the base of a desk stand that it may be removed as a unit without disconnecting the wiring or laying bare the terminals. The normal contact between the wiring and the sender is obtained through spring-contact plates. This patent is assigned to the Corwin Telephone Manufacturing Company. Mr. R. C. Nevin has patented an unusual type of sender. He arranges the apparatus in the vertical body of the desk stand as in the illustration. The finger plate can be slid vertically, carrying with it a notched bar. Both bar and finger plate are attached to a dashpot so that the fall of the bar is under control and at constant speed. The falling bar causes the control contacts to close and open as its teeth pass over them. The number of teeth necessary to pass over the contacts for any one digit depends, of course, upon the height from which the fall begins.

EXCITING COIL

It is well known that the permeability of iron is not great when the degree of magnetization is low. Because of this it is claimed by Mr. J. H. Cuntz, of Hoboken, N. J., that the ordinary repeating coil does not work at maximum efficiency; therefore he provides an auxiliary exciting coil, which is used to raise the magnetization of the iron to a point where the permeability will be near a maximum.

The accompanying illustration shows a heat-coil arrangement patented by Mr. John Erickson, of Chicago, who has assigned his patent to the Automatic Electric Company. The operation is quite evident when it is understood that the small movable finger is held in position by fusible metal, which melts and releases the finger with the flow of abnormal current.



HEAT-COIL ARRANGEMENT

Mr. J. H. Roberts has invented a ringer designed for special operation. The ringer is of the usual polarized type, but it is so designed that excitation with the opposite polarity shall operate the armature but not move the bell clapper. To accomplish this a flaring tube is mounted upon the armature and the bell clapper is suspended within the tube. The position of the armature is so adjusted that when the clapper is midway between the gongs it will bear upon one surface of the flaring tube. When the armature is tilted slightly this surface drives the rod, the latter being returned by a spring with the return of the armature. When, on the other hand, the armature is tilted in the other direction the conical tube swings freely about the bell clapper, which at this time is held against a stop. This patent is assigned to the Homer Roberts Telephone Company.

IMPULSE TRANSMITTER

Another patent of Mr. R. C. Nevin, of Oakland, Cal., describes an impulse transmitter contained within the vertical tube of the desk telephone. A dashpot is arranged within the upright, and the actuating rack is carried by the movable member of this. A stud attached to this movable member projects through a slot, and when it is desired to send any number of impulses the stud is raised in the slot to the proper height, as shown by a graduated scale on the tube. When the stud is pushed into the notch it slips behind the wall of the upright and then returns slowly to normal position, the speed of return being adjusted by the air leak in the dashpot. It will be seen that as soon as a call is started the stud is hidden from view and the speed of return cannot be interfered with.

A receiver supporting arm has been patented by Mr. C. F. Dolle, of Cincinnati. The arm is mounted upon a stud secured in the base piece and arranged to revolve on a horizontal axis lying along the center line of the stud. The supporting arm is secured to the stud by a horizontal screw and stands normally in a vertical position. However, it may be swung a slight distance out of the vertical in a plane including the axis of the stud. In practice the desk instrument is clamped upon the base, and when it is desired to use the telephone the arm is swung forward, the stud turning on its axis. When the telephone is not in use the arm is pushed back and a collar engages the hook switch to hold it open.

POLE CHANGER

Mr. C. J. Erickson, of Chicago, has invented a new type of pole changer, with two moving armatures, one for driving the pole-changing contacts and the other for controlling the frequency. Both armatures are operated simultaneously by a single pair of electromagnets, one armature being suspended at each end of the magnets. The weighted armature has a back contact which controls the supply of energy to the operating magnets.

Letters to the Editors

Electric-Fuse Construction

To the Editors of the Electrical World:

SIRS:—My attention has been called to an article on "Electrical Fuse Testing," by Dr. A. A. Somerville, in your issue of Jan. 18, 1913, which seems to be full of hasty and unwarranted conclusions. I have also read the communication from Mr. L. W. Downes, appearing in your issue of Feb. 22, 1913, which so ably controverts the conclusions of Dr. Somerville that I do not feel that anything I could say, however fortified by record of experiments with inclosed fuses made under my observation in a long period of years, would add a feather's weight to the truth of Mr. Downes' statements, which are facts, proved and re-proved, some of them being now on record in the federal court.

Your readers' attention might, however, be directed to the danger, from the standpoint of fire hazard and personal safety, of using a type of inclosed fuse which does not comply with the Underwriters' requirements, as follows: "The fusible wire must be attached to the terminals in such a way that a thoroughly good connection is secured and so as to make it difficult for it to be replaced when melted," namely, the so-called refillable fuse. The public has learned that the standard approved inclosed fuse is a reliable and effective electrical device, because it is approved by the Underwriters and has been used with satisfaction. What they do not generally know is the severe physical conditions to which those fuses are subjected in ordinary practical use and the scientific skill, care, experiment, labor and time expended by the Underwriters and the manufacturers to have them operate safely and reliably. Attention should be called to an article by Mr. L. W. Downes in the *Transactions* of the American Institute of Electrical Engineers, page 947, Vol. XXVIII, 1909, and one by Mr. F. N. Conant in Stone & Webster's *Public Service Journal*, page 180, 1911, for real information backed up by oscillograph and careful observation records as to actual conditions met by modern standard inclosed fuses.

Disastrous results might occur from accepting too fully the statements by Dr. Somerville that "any metal may be used as a fuse strip," "any kind of wire may be used as a fuse" and "the character of the insulating powders used around the fuse wire is without effect except in a thermal way."

A refillable fuse, reloaded with two or three pieces of metal designed therefor, and carelessly filled with its sec-

ond-hand filler, is a sufficient cause of apprehension, and one reloaded with copper, iron or aluminum wire with or without filler will be a greater source of fear; but one containing aluminum or magnesium wire and manganese dioxide filler, a possible combination under the suggestion by Dr. Somerville, is extremely dangerous. A mixture of aluminum or magnesium and manganese dioxide is one of the most powerful Goldschmidt Thermit mixtures that can be produced. "Fuse" is an excellent name for it, because it is capable of fusing every known metal when properly ignited. A large fuse thus made, particularly when the filling had already been used once or twice, would give ideal conditions for a Goldschmidt reaction when the fuse blew on short-circuit; that is, hot, finely divided aluminum or magnesium, manganese dioxide and electric arc ignition. Aside from this possibility, manganese dioxide is a conductor, though not a very good one, at ordinary temperature, having a resistance about 500,000 times that of copper, decreasing with rise of temperature, and on heavy short-circuit it might develop the Nernst effect (discovered by Mr. Downes in high-tension inclosed fuses even with fillers of highest resistance) on low-tension service. In any event it will yield free oxygen if its temperature reaches 600 deg. C. The possibility of such combinations with fuses being reloaded by 200,000 engineers, janitors, wiremen and handy men, here, there and everywhere, would represent a menace to property and public safety.

The larger companies manufacturing fuses have spent hundreds of thousands of dollars in evolving and perfecting these devices. Some of them have been at such work for more than twenty years, employing men of high technical and practical knowledge and skill and making use of apparatus of enormous value in order to duplicate practical conditions; furthermore, use has been made of every method of production and efficiency engineering to secure economy of manufacture. If old iron or other cheap wires and filling materials could be safely used in inclosed fuses, the manufacturers would not only know this fact but they would use such materials instead of special alloys of special design and special filling material made by special processes which render them more expensive, because it is fair to assume that under existing conditions of competition an equally satisfactory and cheaper construction would long since have been eagerly seized upon as a source of advantage.

L. B. Buchanan,
Boston, Mass. Engineer for Stone & Webster.

Light Distribution Curves

To the Editors of the Electrical World:

Sirs:—After reading over the article by Mr. R. F. Pierce in your issue of Feb. 8, 1913, I am moved to take the position of defending the time-honored intensity distribution curve. Although I agree with Mr. Pierce in much that he has written, I am of the opinion that there is much to be said on the other side of the question that has not been mentioned in his article.

The candle-power distribution curve has no doubt been much misinterpreted. It is true that many assume that the area of the curve furnishes a measure of the flux emitted. The practice of picturing light rays penetrating darkness in advertising matter pertaining to lighting units has been the cause of others looking upon the distribution curve as an "iso-normal-illumination" diagram; that is, a point on the curve is taken to indicate the distance over which the ray can travel before the illumination normal to its direction falls to a given value. It is doubtful if the proposed method would help in either of these cases in the attainment of the desired results.

In the first case, the more important one, the misconception arises from the lack of appreciation of the difference in the areas of the zones, but a person will not have gone far wrong when he goes through the next step in forming an idea of the resulting intensities on some horizontal plane in question. The long radii vectores of the curve of an intensive reflector unit in the lower angles do not give any conception of flux. They represent little flux, but along with this is the fact that the areas covered are so small that only little flux is needed to bring the intensity of illumination to a high value. It seems to me that neither method can meet the requirements of minds wholly untrained in such matters and that the one is no better than the other.

Notwithstanding all that has been said against the method of comparing lighting systems on the basis of illumination on an arbitrary working plane, nearly all illuminating engineers make use of such data in their design problems, and knowledge of this sort is unquestionably valuable. It is desirable not only to know average illumination values but also to know the variations. The ratio of highest to lowest illumination is taken into account by engineers in deciding upon a design. These figures cannot be readily obtained from the proposed curves, while on the other hand the flux values can very conveniently be taken from the candle-power distribution curve. By one method it is necessary only to measure the horizontal distance from the point on the polar curve to the vertical axis, to the candle-power scale, and to increase the figure 10 per cent, to obtain the flux in a zone of 5 deg. each way from the point in question. The experienced engineer can measure this distance fairly well with the eye and increasing the figure 10 per cent is the very easiest kind of a mental calculation.

Since our modern sources differ from the old candle, in that they vary considerably in intensity, depending upon the direction from which they are viewed, it would seem that an intensity curve or diagram giving that information would be exactly the thing needed. It is not surprising that this has been obtained by revolving the source about its axis of symmetry and thereby simplifying the whole task by obtaining and later plotting one value which represents the average of the intensities in a complete series of directions, which intensities should by reason of the symmetry of the source be nearly the same. The method is so simple that it has been extended to use with sources that lack this symmetry, but with an appreciation of its limitations. In fact, the amount of labor involved in obtaining more exact information is prohibitive. The results are obtained in terms of intensity. Why change them at once into terms of light flux, thereby obscuring at once much of the information of value?

Granting that only the average illumination of a surface found in a certain zone were wanted, even then the proposed method would not be entirely satisfactory, because the flux curve must, with one scale, take care of a far greater range of magnitudes than is needed on the regular distribution curve. It is readily seen that with the proposed curve it would be very difficult to obtain even a rough estimate of the illumination directly under the source. The curves of Fig. 2 in the article by Mr. Pierce will illustrate this point. It is apparent from a glance at the candle-power curves that the illumination over a surface included in the 5-deg. angle would be six times as great for the F as for the E unit. No one could tell what it would be from the flux curves plotted to the scale as shown.

I do not wish to be understood as attempting to discourage in any way the more general use of flux measure. Light sources should, of course, be rated in lumens rather than in candle-power. The light flux concept is useful in many ways, but it seems to me that the intensity concept is fully as useful and necessary and, as a matter of fact, just as logical in every way.

Cleveland, Ohio. Evan J. Edwards.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Sole-Plates and Shoes for Electrical Machine Foundations

BY F. B. DUGGAN.

There exists considerable confusion in regard to the use of the terms "sole-plate" and "shoe," and furthermore, the functions of these two devices do not appear to be thoroughly understood by the men that erect and operate generators and motors. The object of this article is to define clearly

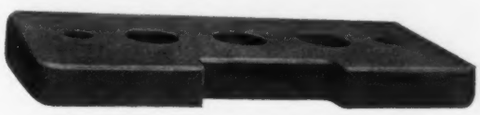


FIG. 1—SOLE-PLATE FOR DYNAMO FOUNDATION

these terms and to indicate how sole-plates and shoes should be used.

There are three methods in common use for supporting engine-type electric-generator and large electric-motor stators on their foundations or bed-plates.

The method with a sole-plate (Figs. 1 to 4) is used only where the stator is supported on a foundation without an intervening rail, and where it is not necessary to provide means for quickly adjusting the stator relative to the rotor. The method is seldom used with alternating-current machines, because with these provision must usually be made for shifting the stator in a direction parallel with the shaft, to provide for inspection and repair of the armature and field coils.

As a general thing, with direct-current machines, at times when the armature or field coils must be inspected, the upper half of the field frame is removed and the lower half is not shifted from its position on the foundation. Therefore, sole-plates are most frequently used for supporting direct-current machine frames where there is no bed-plate. The generator frame foot rests on the sole-plate, which in

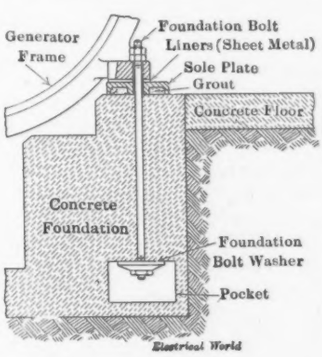


FIG. 2—SECTIONAL VIEW OF SOLE-PLATE INSTALLED

turn rests on a grout bedding directly on the foundation.

The second method is with rails and shoes (Figs. 5 to 7). This method is used for practically all engine and coupled-type alternating-current machines except those that are small enough to be handled readily as complete units. The shoe construction permits the accurate and speedy alignment of the stator after it has been shifted along the shaft to permit inspection or repair of armature or field coils. It is not feasible to lift off the upper half of the frame of an alternating-current unit without incurring considerable trouble and not a little expense, even if the frame is split horizontally, because such procedure would involve unsoldering the connections of the armature coils that bridge the split.

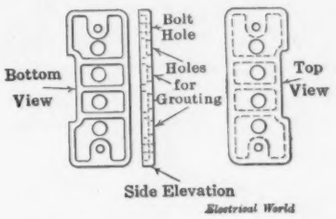


FIG. 3—DETAILS OF SOLE-PLATE

The rail is supported directly on the foundation. The shoe rests and slides on the rail and the generator is carried on the shoe; the adjusting studs and clamping bolts afford means of positively and readily adjusting the stator and clamping it in proper position.

Frequently with large, heavy units carriers are provided, which consist of a series of rollers held between two bars. A carrier is placed in the groove in each rail. In using the carrier the frame must be raised about 1/16 in. with the elevating screws, when the carriers can be rolled under, one carrier under each shoe. Then the frame can be lowered onto the shoes and readily pried along the rails with pry-bars.

The employment of a common cast-iron base for the prime mover and generator constitutes the third method. On direct-current machines the feet may be bolted and doweled directly to the base. The base of alternating-current machines may be grooved so as to constitute a rail and the generator can be supported by and adjusted on a shoe

FIG. 4—APPLICATION OF SOLE-PLATE

sliding on this rail. Obviously, a common cast-iron base is feasible only for units of relatively small size.

Sole-plates are merely foundation caps or cast-iron-bearing plates for forming a smooth surface on top of a foundation, to distribute the weight and upon which the feet of the machine can rest. The method of using a sole-plate is shown in Fig. 2. None of the holes through the plate is threaded. The foundation bolts extend through the plate

and down into the foundation the usual distance. In addition to the bolt holes, large holes are cast through in the plate to provide for the admission of the grout.

In setting the plate it is carefully leveled and aligned and grout is poured through the holes to cement it in position. Frequently, instead of the plate being arranged above the foundation surface, as in Fig. 2, it is built in flush with

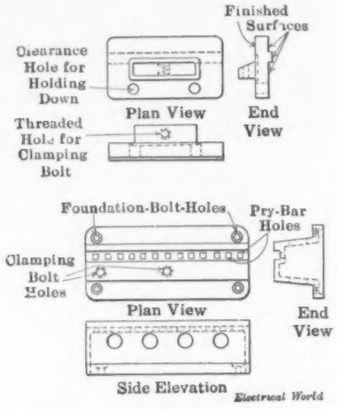


FIG. 5—DETAILS OF RAIL

the surface of the foundation. The plate is always set in or on the foundation somewhat lower, possibly ⅛ in., than the elevation that the bottom face of the generator foot will occupy, so as to permit the insertion of liners or thin plates of metal to bring the generator accurately to the required elevation. Studs, turning in threaded holes in the generator feet, are frequently arranged to provide a means of quickly and accurately leveling a machine. The lower ends of the studs bear against, but do not pass into or through, the sole-plate.

The foundation bolt-holes through the feet of the generator should be enough larger than the bolts for the machine to be shifted somewhat to align it accurately with the shaft. The radial clearance between bolt and side of hole should be about ⅛ in. for small units and possibly

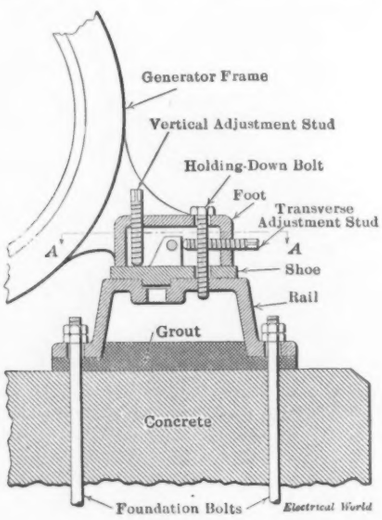


FIG. 6—SECTION OF SHOE AND RAIL-ADJUSTING ARRANGEMENT

¼ in. for large ones. After the generator has been brought into exactly the proper position, the nut turning on the top of each foundation bolt is screwed down tightly, which clamps the machine in position. A lock nut is often turned down on top of the first nut, as shown in Fig. 2.

In Figs. 5 to 7 are shown the components for a shoe-and-rail electrical-machine supporting arrangement. As mentioned above, the function of the shoe is to provide a means whereby the frame of an electrical machine can be readily shifted transversely and longitudinally by fine increments to provide for delicate adjustment. Fig. 6 shows the shoe, a casting, with an elongated raised lug upon its upper face. The transverse clamping bolt turns in a threaded hole in this shoe and the ends of the longitudinal and transverse adjustment studs bear against it. A shoe fits under each of the feet of a machine, the lug extending up into the hollow space in the foot. On the bottom of the shoe is a tongue extending its entire length. This tongue fits a longitudinal groove in the rail or in the common base, if there is such, that carries the prime mover and generator.

In Fig. 5 are given the details of a rail on which a shoe, such as that above described, rides. It is a cored-out casting having plain and tapped holes to accommodate respectively the foundation and the clamping bolts. Through the bottom of the groove in which the tongue on the shoe engages are square holes. These are provided to form a gripping space for the pry-bar that is used in shifting the generator along the rails when it is necessary to move it for armature or field inspection. After having been removed and returned approximately to its proper position with the pry-bar, the adjusting screws are used to adjust accurately the frame in relation to the rotor.

Figs. 6 and 7 show sections of one foot, its shoe and the adjusting and clamping screws. It will be noted that there are two adjusting studs at each foot, one bearing against each end of the lug on the shoe, so that the frame can be

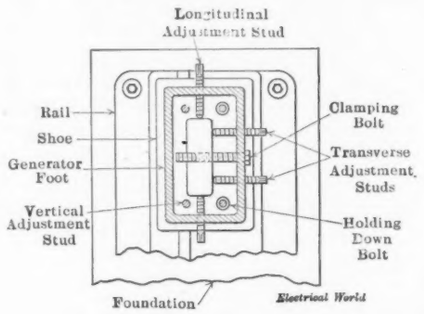


FIG. 7—PLAN OF SHOE AND RAIL-ADJUSTING ARRANGEMENT

adjusted in either direction. For transverse adjustment two adjusting studs and a clamping bolt are provided at each shoe. Transverse movement of the frame is effected by manipulating the adjustment studs, and, after the frame is located, it is clamped in position by setting the clamping bolts, which perform functions similar to those of lock nuts.

Two or more studs are provided in each foot for vertical adjustment. By turning one, two, three or four of the studs by the right amount, the frame can be brought precisely into the proper elevation with very little trouble. Thin metal liners, to the correct thickness, are inserted between the shoe and foot after the proper elevation has been obtained. Then the holding-down bolts are tightened, which firmly maintain the frame where it belongs. On superficial examination one would obtain the impression that there are more adjusting and holding screws in connection with the shoe than are actually necessary. Experience, however, has indicated that every one shown is necessary to effect quick, accurate adjustment and to maintain effectively the adjustment after it has been once made.

Prior to the placing of the machine on it the rail should be carefully aligned and leveled. It should be grouted, as suggested in the illustration, to insure a firm, uniform bearing on the foundation face. Although the various adjusting devices provide for the correction of a certain amount of error in setting the rails, it is always a good plan to set them in the beginning as accurately as possible, both as to alignment and elevation.

The Obsolete Belt Drive in Power Stations

BY ALFRED KENNEDY

During several years past numerous hydroelectric plants and their equipment have been described in the *Electrical World,* and in every instance where oil pressure governors have been used the statement has invariably been made that "the governor pumps are driven by belts from the main shaft."

The writer, from experience gained as general repairman in a large hydroelectric plant where a number of belt-driven pumps are in use, believes that these pumps should be motor-driven, as the belts, though comparatively small, are capable of doing considerable damage to other equipment and are a source of constant and unnecessary danger to the employees of the plant.

Here is a case in point. One night one of these belts slipped, eventually running off its pulleys and becoming entangled around the shaft, with the loose loop threshing around like a flail, striking the floor with great force at every revolution of the unit. Close to the shaft, but on the opposite side from the pump, a tachometer was mounted on a frame made from ½-in. by 2-in. iron and bolted to the concrete floor. The flying loop of the belt caught on this frame, tore it from its fastenings, breaking the ½-in. by 2-in. iron bars in several places, and reduced both the frame and the tachometer to scrap iron. The belt was not greatly injured; in fact, it is still doing duty on the same pump. As it sometimes becomes necessary to throw these belts off the pulleys while the unit is running, in order to stop the pump, it is not very hard to imagine what would happen to an employee should he, under the same circumstances, be so unfortunate as to get an arm or a leg caught in this loop. In the case mentioned above, if one of the pieces of iron had found its way into the clearance space between the rotor and stator a burned-out generator would naturally have been the result.

On another occasion one of these belts while being replaced on the pulleys caught on a gage cock on the nearby pressure tank and, breaking it off, allowed a considerable quantity of oil, under pressure, to escape, bespattering the generator, floor and walls of the power house.

As stated above, there are times when it becomes necessary to stop the pump while the unit is running, and the only way to accomplish this is to throw the belt off the pulleys. To start it again the belt would have to be replaced with the unit still running (and, needless to say, both these operations have been the cause of fatal accidents ever since belts have been in use) or else a shut-down for the same purpose would be necessary, if the load carried at the time would permit.

Moreover, in starting a unit it may become necessary to pump to the required pressure (perhaps previously lost in order to effect needed running repairs), which generally takes about an hour, and, with the belt drive, during this time the turbine cannot be put under the control of the governor. With a motor drive the pump could be started and pressure got up beforehand so the governor could be made to control the turbine immediately.

The writer never could understand why a power company would build a large substantial plant, sparing no expense in installing the most modern and up-to-date machinery and equipment, and then retrograde a hundred years in adopting belt drive for the governor pumps. Furthermore, central stations generally have commercial agents in the field doing their best to induce manufacturers to install individual motor drives, and in continuing to use the ancient, obsolete, inconvenient and dangerous belt the power companies are certainly setting a poor example to their prospective customers, especially in a case of this kind, where a motor drive can be so easily applied with an expenditure small in comparison with the advantages and safety thereby obtained.

Balancing the Rotors of Turbo-Alternators

How are the rotating parts of turbo-alternators balanced in the large manufacturing plants of the United States? Is the general European practice in accordance with the methods in use in this country?

F. C. W.

In American factories practically all turbo-alternators are balanced by a cut-and-try process. The turbine is first assembled on the test floor and connected to the steam and exhaust mains and to the oil and water systems of the plant. As the machine is driven under its own power, the test men determine which end of the machine is the roughest by placing the forehead against the casing at different places. A weight is then inserted into one of the tapped holes provided in the runner, and the machine is speeded up, the result of the "shot" being noted. If the vibrations are less violent but still noticeable, another and heavier weight may be inserted in the same hole. If the first attempt produces more violent vibrations, the weight is removed and placed in some other part of the runner. Each tester generally has his own "follow-up scheme" of placing the successive weights. This process is continued until both ends of the turbine are free from vibration at rated speed. When the generator is attached to the shaft this process is repeated and weights are placed upon the ends of the rotor at various points on the circumference until all bearings and the casings of both the turbine and the generator are free from vibrations as far as can be detected by placing the forehead against them. Many of the foreign factories balance the rotors of their generators dynamically before they are assembled in the machine. Special apparatus fitted with delicate balancing mechanisms is required in this work. As a precautionary measure these machines are generally subjected to a high-speed test before they are allowed to leave the factory.

Ice-Making by the Flooded System

What is meant by the flooded system of ice-making and what are its advantages?

R. H. O.

In the ordinary or so-called "dry" expansion system of ammonia refrigeration the liquid ammonia is allowed to expand in coils of pipe usually immersed in a tank of brine. During the expansion of the ammonia from a liquid to a gaseous state it absorbs heat from the adjacent brine. Only a limited amount of the liquid ammonia is used in the "dry system," and during its passage of the expansion coils this liquid is all changed to gas. In the "flooded system," however, more liquid ammonia is put into the coils than can be evaporated by the refrigerating work to be done. For this reason slugs of liquid ammonia are carried through the pipes along with the gas. This surplus liquid is conserved, of course, by being allowed to drop back into an accumulator containing the liquid ammonia from which the coils are supplied. It then undergoes another passage of the expansion coils so that none of the compression work is lost.

The flooded system has the advantage of insuring equal distribution of refrigeration throughout the coils owing to the fact that alternate slugs of liquid ammonia and gas pass entirely through the pipe, so that even when the final section has been reached there is still an excess of liquid to be expanded. The presence of the liquid ammonia in the pipes makes the mixture a better thermal conductor than the dry gas alone would be, thus more readily transmitting heat from the pipe walls to the expanding fluid.

The flooded system allows the expansion coils to be operated at a thermal density nearly 75 per cent higher than can be obtained with the dry system, and with greater efficiency. About 60 per cent more ammonia is required to charge the system, but this material remains in the coils and the work of compression is approximately the same as in the dry system.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Three-Phase Series Commutator Motors.—L. Binder and E. Dyhr.—The first part of a mathematical article on three-phase commutator series motors with a double set of brushes as built by the Siemens-Schuckert company. These machines are able to return electrical energy into the network to which they are connected if they are mechanically driven and if the position of the brushes is properly adjusted. But in this case self-excitation of the machine may become troublesome. The object of the paper is to discuss how the self-excited currents in these machines are produced and how they can be suppressed. The article is to be continued.—*Elek. Zeit.,* Feb. 20, 1913.

Cascade Induction Motor.—M. I. Williams-Ellis.—An illustrated reprint in abstract of a paper read before the South African Institution of Engineers. The first part deals with the early work on cascade construction of Silvanus P. Thompson, Steinmetz, and Georges and Lydall; the second part gives a description of the cascade induction motor of the single-speed and multi-speed type, and its adaptability to mining and general work. There are also references to other multi-speed types of motors.—London *Electrician,* Feb. 21, 1913.

Phase Compensator.—A. Scherbius.—A French translation in abstract of his German paper noticed some time ago in the *Digest* on the Brown-Boveri phase compensator for induction motors.—*La Revue Elec.,* Feb. 21, 1913.

Commutation.—A. Manduit.—In a continuation of his long illustrated paper read before the International Society of Electricians in Paris on the problem of commutation in direct-current generators, the author gives an account of his experiments on artificial commutation with oscillographic tests. He describes in detail the arrangement of the experiments.—*La Revue Elec.,* Feb. 21, 1913.

Signs and Direction of Rotation.—A. Scherbius.—An article profusely illustrated by diagrams on the use of signs or direction of currents in polyphase systems. The author summarizes old and new agreements concerning signs of direction and illustrates by an example the object of such agreements. This example relates to the determination of the direction of currents in a polyphase commutator machine.—*Elek. Zeit.,* Feb. 20, 1913.

Lamps and Lighting

Tungsten Lamps.—O. P. Andersen.—An illustrated article on electric sign lighting with tungsten lamps, containing specific information on utilizing the new lamps to the best advantage electrically. It gives a description of the various types of lamps on the market and instructions as to their selection for any special conditions. Specific directions (including diagrams and tables) as to the number of lamps, layout of circuits and sizes of wire, applying both to re-equipping of old carbon lamp signs and to design of new signs, conclude the article.—*Gen. Elec. Review,* March, 1913.

Generation, Transmission and Distribution

Electrical Distribution for Mines.—J. W. Anson.—An article on details of electrical distribution in South African mines, the power being bought from a large power company. The author emphasizes the great importance of proper design of the switch gear in the transformer house of the mining company, as this is the only portion of the electrical equipment which cannot be duplicated. He shows how to lay out the general features of the equipment as to busbars, main feeder panels and general arrangement. For the mine feeder cable three-core, paper-insulated, lead-covered, served, double-steel tape or steel tape armored, and served over all, is excellent. In the design of the cable network attention must be paid to reliability of supply to all important motors, to the facility of taking any one or two mine cables off load for the purpose of working on their respective switches or panels in the transformer house, and to the facility of learning quickly the cost of electrical power used for the various purposes at the end of each month. The author then discusses in detail the electric driving of the following machines: winder motors, mine pumps, mills, lift tailings pumps, tube mills, return water pumps, pumps in slime pump houses, pumps, etc., in extractor house, dump haulage motor or motors, mill haulage, butters' filter plant motors, belt motors, etc., for sands plant.—*Transactions of South African Inst. Elec. Eng.,* December, 1912.

Dangerous Rises of Voltage.—W. Petersen.—A continuation of his long article in which he gives further examples of the various causes which may produce traveling waves in networks and which may result in dangerous rises of voltage. Any portion of the network which is separated from the rest of the network by an inductance has a tendency to concentrate in itself the electric energy from adjoining parts of the network when a transient phenomenon starts. Since transformers, etc., are necessary in the network, provision must be made for traveling waves to pass over them. The article is to be concluded.—*Elek. Zeit.,* Feb. 20, 1913.

Traction

High-Tension Lines for Railways.—E. S. Seefehlner.—The conclusion of his profusely illustrated article on the best methods of constructing an overhead high-tension line for electric railways with special reference to the suspension of the trolley wire and the construction of the insulators.—*Elek. Zeit.,* Feb. 20, 1913.

Installations, Systems and Appliances

Control of Switches from a Distance.—A description of the use at the Egham and Staines central station in England of the method of remote control of switches described in the paper of Duddell in the *Digest* last week. The Egham and Staines system is a single-phase plant, the energy being generated at 2000 volts and 50 cycles. Two concentric feeders transmit the supply to Egham and Staines respectively, where the emf is transformed to 200 volts by transformers placed in street kiosks and distributed on the three-wire system by three-core cables. The "ripple" alternator is installed in a corner of the engine room and is driven by a synchronous motor. It is at present used only in connection with the consumers' meters, and only one frequency is required. For a complete scheme, where several frequencies would be used, the speed of the alternator would have to be varied and a continuous-current motor would probably be used to drive it. The alternator is of the rotating magnet type and the armature is connected in series with the main generator on the outer or earthed main. The whole of the main current passes through the alternator, about 20 amp maximum in this case. The

ripple is used to work relays which cut out the shunt circuits of consumers' watt-hour meters for definite intervals of time, thus giving the consumers so many kilowatt-hours unmetered, which is equivalent to charging a lower price per kilowatt-hour. The alternator is thus kept running all day, but is shut down during the peak load, when all kilowatt-hours consumed are charged for. An arrangement of cams connected with the shaft of the alternator is caused to make and break the exciting circuit of the alternator at the proper intervals, the breaking of this circuit being, of course, equivalent to removing the ripple. The alternator generates current at about 140 volts with a frequency of 200 cycles. The pressure is transformed to about 7 volts on the low-tension network, which is sufficient to work the relays. An experimental relay was connected to an ordinary lamp holder in a shop distant from the station by some 11 miles of high-tension feeder, and it was seen responding to the alternator as the ripple was imposed and removed. Not the slightest flicker could be detected in a lamp connected as usual across the mains. The relays in use consist of an iron-cored coil and condenser joined in series. A balanced armature is attracted to an electromagnet, and when current of the right frequency is received a very definite pull is obtained on the armature. The system is partly applicable in controlling street lamps, in operating the main switches of consumers supplied on a restricted hour basis and in railway track signaling.—London *Electrician,* Feb. 21, 1913.

Lighting Batteries.—An account of the discussion at Manchester of Whysall's recent paper on the use of a large lighting battery in connection with central-station supply. P. H. Whysall said that the situation of the battery depends entirely on the circumstances and the system. In the case of a large direct-current system the advantage is in favor of putting a large battery down at the generating station. In the case of a three-phase system with substation the best place is the substation. As regards the rating of the battery, whether it should be one-hour, two-hour or three-hour, he considered that a one-hour rating to carry over the peak is sufficient. S. J. Watson thought that the fairest method of rating the battery is to take it on the basis of a two-hour rating, because the primary use of a battery is in connection with peak loads. The importance of proper design of the battery switchboard was pointed out. P. P. Wheelwright and C. L. E. Stewart had found that they got the best results by giving their batteries a "rough time."—London *Electrician,* Feb. 14, 1913.

Arcing Ground Suppressor.—R. H. MARVIN.—An article in which the author describes the arcing ground suppressor and its uses, indicates its field of application, shows the difference in its construction for overhead and underground systems, and explains, with diagram, the operating cycle. The most effective protection is obtained by its location at the power house.—*Gen. Elec. Rev.,* March, 1913.

Advertising Electricity.—H. C. PALMER.—A paper read before the Manchester Section of the (British) Institution of Electrical Engineers on methods of popularizing the uses of electricity. The author deals with press advertising, literature and circularizing, the provision of a central information bureau, local bill posting, and electric signs.—London *Electrician,* Feb. 14, 1913.

Parallel Operation.—An account of the discussion which followed the presentation of the paper by A. R. Everest on some factors in parallel operation and in which Miles Walker, S. P. Smith and E. Rosenberg participated. The latter gave diagrams for the flywheel effect required if it is desired that the natural frequency of the machine shall be below the frequency of the engine oscillations. He emphasized the fact that the damper windings are in some cases of great importance as they allow the saving of many tons of flywheel.—London *Electrician,* Feb. 21, 1913.

Electric Heating of Water.—A. RITTERSHAUSEN.—An illustrated English translation in abstract of his German paper, abstracted in the *Digest,* on domestic water heating by electricity and giving details of the Rittershausen water heater.—London *Electrician,* Feb. 21, 1913.

Electricity for Breweries.—K. IFFLAND.—The conclusion of his article. The author gives extended data on the cost of generating energy in a private station or buying the energy from the central station under the conditions which obtain for the breweries of the city of Dortmund. The figures show that the Dortmund breweries can, by buying the energy from the municipal station, make considerable savings even if they buy it at the normal tariff rates.—*Elek. Zeit.,* Feb. 20, 1913.

Wires, Wiring and Conduits

Disadvantages of Steel Tubes for Each Individual Phase Conductor of a Single-Phase or Three-Phase System.—L. BLOCH.—The author emphasizes the great disadvantages and serious heating phenomena which may occur when each individual phase conductor of a single-phase or polyphase system is placed in a steel tube. In this case the magnetic field of each conductor is greatly increased and the eddy currents produced result in additional losses and in an increase of the temperature of the tubes and of the wire. If the two conductors of a single-phase system or the three conductors of a three-phase system are placed together in a tube, no such effect is possible since the actions of the different conductors compensate each other. The author gives results of experiments made by the Berlin Electricity Works with various systems of wiring. It is shown that to place the individual conductors of an alternating-current network in steel tubes is very disadvantageous with currents above 50 amp and should be avoided also with lower currents, not only on account of the increase in temperature but also on account of the greater losses and the serious increase of the voltage drop. If the individual conductors are placed in paper tubes with leaded iron armor the increase of temperature is not dangerous, but with greater currents an increase of voltage drop may be produced which can cause considerable trouble. With currents above 100 amp this method of wiring should be avoided under all circumstances. To place each conductor in a paper tube with brass armor is harmless. The results of the experiments showing the increase of voltage drop, losses and temperature are given in tables and diagrams.—*Elek. Zeit.,* Feb. 20, 1913.

Electrophysics and Magnetism

Maximum Voltage Gradient in a Spark-Gap in Terms of the Radius of Curvature of the Electrodes.—GEORGE R. DEAN.—This article is the outcome of a special line of study followed up in connection with research work on the dielectric strength of air. Values for the dielectric strength of air are usually based on tests of breakdown voltage between metallic electrodes spaced at given distances. Whatever the potential and shape of the electrodes, it is necessary to have a means of computing the maximum voltage gradient between them, and most of the methods which have heretofore been proposed have been either highly involved or of limited applicability. The author employs only elementary algebra and trigonometry in evolving an exceedingly simple working formula, and he shows, moreover, that the spherical form of electrode may be departed from considerably provided the curvature of the spark point is known.—*Gen. Elec. Rev.,* March, 1913.

Phosphorescence.—C. A. BUTMAN.—The author deals especially with the mechanism of light production and with the cost of the spectra of phosphorescent materials.—*Phys. Rev.,* February, 1913.

Electrochemistry and Batteries

Manufacture of Fireproof Molded Conductors.—A note on a recent British patent (No. 16,044, 1912) of Geb. Siemens. A mixture of carbon and silicon is heated in an atmosphere of carbon monoxide or dioxide, so as to produce a molded body of SiCO and free carbon. It is then heated

to from 1600 to 1700 deg. C. in a non-oxidizing atmosphere; the body remaining is composed of SiC.—London *Elec. Eng'ing*, Feb. 20, 1913.

Edison-Lalande Cell.—Dudley Sanford.—An article giving the results of a careful test of an Edison-Lalande cell. The arrangement of the test and the results of the measurements are given in diagrams. The following figures of the cost of electrical energy from primary cells are given: If the zinc in this cell is consumed with 100 per cent efficiency, the cost of producing energy is $2.37 per kw-hr. This is on the assumption that the zinc is the only substance consumed in the production of available energy and that the other materials will be recovered. If, however, the user throws away the remaining materials and buys a complete renewal, the cost will be $9.40 per kw-hr. If the materials are bought in large quantities, this cost may be much reduced—50 per cent in lots of $2,000 or more and proportionately for intermediate quantities. Hence under favorable conditions electrical energy obtained from this highly efficient type of primary battery costs about fifty times the ordinary market price of electrical energy.—*Metall. and Chem. Eng'ing*, March, 1913.

Units, Measurements and Instruments

Magnifying Feeble Signaling Currents.—S. G. Brown.—An illustrated lecture delivered at the last exhibition of apparatus of the Physical Society of London. The instruments described by the author are designed primarily for cable work, but they are equally applicable to recording many other kinds of signaling impulses. He first describes a modification of the siphon recorder which increases its efficiency considerably. He then describes a thermo-electric magnifying relay (Fig. 1) in which the power in the relay circuit is generated by means of five thermo-junctions at different temperatures. The heat is supplied by two little flames *CC*, and a very light thermopile *B* is suspended so as to swing in and out of the flames and is coupled to a moving coil through which the received currents pass. The thermopiles consist of alternate junctions of platinum and platinum + 20 per cent iridium, wires being used of 1-mil diameter. Under the saddle which carries the thermopile the two silk fibers are stretched, and to one of these the cross-fiber which transmits the movements of the coil to the thermopile is attached. The top and bottom suspensions are of fine phosphor bronze wire and serve as leading-in wires to the thermopile. The curve (Fig. 2) was taken from a thermopile with seven junctions on each side. When the thermopile was deflected 0.075 second of arc the current it sent through a resistance of 42 ohms (equal to its own resistance) was 0.81 milliampere. With the natural period of the coil equal to 8.7 per second and a 480-ohm, 480-turn coil, a current of 0.03 milliamepere through the coil gave

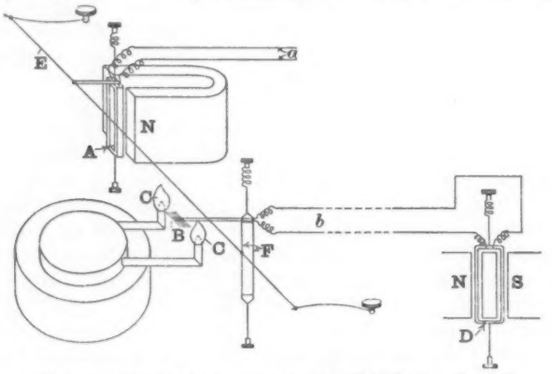


FIG. 1—THERMO-ELECTRIC MAGNIFYING RELAY

a current of 0.81 milliampere from the pile through an external resistance of 42 ohms. For slowly changing currents this corresponds to a magnification of power of about twenty-seven-fold, and, of course, this can be greatly increased by reducing the period of the coil. For quickly changing movements the power magnification is not so great, owing to the back emf of the coil. Trials of this instrument on an Atlantic cable have shown an increase in speed of about 40 per cent. Fig. 3 shows an entirely mechanical relay in which movements operated by very small forces

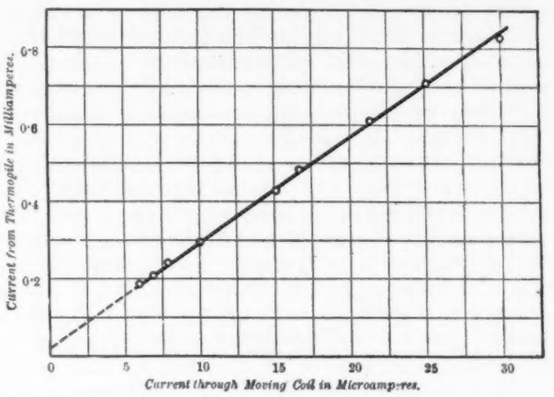


FIG. 2—CURVE FROM THERMOPILE WITH SEVEN JUNCTIONS

are largely increased in strength without affecting their motion. The relay consists in principle of a rotating spindle around which are wound one or more turns of a flexible cord. The spindle is revolving in such a direction as to pull away from the magnified forces and toward the small forces that control the movement. Suppose a heavy weight has to be raised by a force of one-tenth of the amount, it will obviously be necessary to supply 90 per cent additional energy, and this is supplied by the motor driving the spindle. The magnification of force and energy depends on the number of turns which the cord makes round the spindle and follows a compound interest law. Fig. 3 shows an

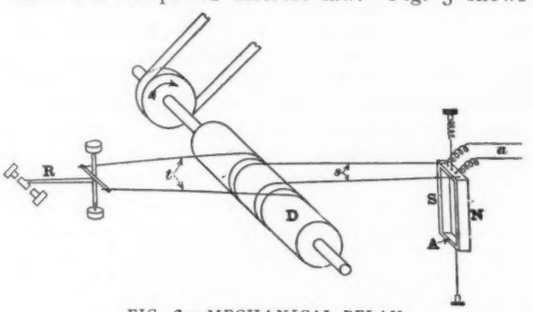


FIG. 3—MECHANICAL RELAY

application of the principle to cable work, in which the small forces operating the coil *A* are intensified sufficiently to work the coarse relay arm *R*. The spindle rotates away from the relay arm *R* and toward the coil and produces a much greater tension in the fibers *t* than in *s*. When the coil swings on its axis the tension is increased in one of the fibers and diminished in the other and a similar change in a magnified degree takes place in the fibers *t*. By using means of this sort it is possible to work an ordinary siphon writer, which normally requires some 3 milliamperes, by a current of 10 microamperes.—London *Electrician*, Feb. 21, 1913.

Telegraphy, Telephony and Signals

Elimination of the Siphon Recorder.—A note on a new system of submarine telegraphy due to John Gott. The system consists in using a current for each signal of an opposite polarity from the preceding and succeeding currents. This is a very small modification from common usage, but it appears that it results in distinct signals passing through the cable instead of signals running together into a continuous indication in the way which renders the use of a siphon recorder necessary. Thus two successive dots would be signaled by two currents of opposite polarity. On that account the ordinary Morse code can be used in

place of that which becomes necessary with the recorder, and thus a land line can be joined up to either end of a submarine cable and an ordinary Morse message can be sent through the combined circuit with an ordinary key. The operation thus becomes much simpler, and for the ordinary key there may be substituted a Wheatstone transmitter; but this does not mean that the speed of signaling will be much increased. The importance of the method lies in the fact that re-transmission at the cable ends may be omitted; in fact, the siphon recorder can be eliminated, and consequently greater accuracy can be obtained, and indirectly a saving of time can be effected. One of the chief uses of the method will no doubt be the linking up of a number of short cables so as to be able to signal directly from end to end. It is possible to transmit ordinary Morse signals from, say, London to New York direct, provided suitable relays are introduced at the ends of the cable. "Experiments have already been conducted between London and New York on this system with satisfactory results."—London *Electrician,* Feb. 21, 1913.

Inductance and Capacity of Linear Conductors.—LOUIS COHEN.—The author gives expressions for the capacity of various arrangements of linear conductors and applies them to the calculation by the capacity of horizontal antennas. The treatment is highly mathematical. The article is to be concluded.—London *Electrician,* Feb. 14, 1913.

Miscellaneous

Electricity for Agriculture.—VON PUTTKAMER.—A paper discussing in a general way the fundamental principles which should be considered in the design and operation of transmission and distribution systems in agricultural districts.—*Elek. Zeit.,* Feb. 20, 1913.

Electric Resistance Welding.—P. BUCHER.—A paper in abstract read at Manchester and giving data on the methods and results of electric resistance welding. The underlying principle of resistance welding—that is, the use of very heavy currents—makes the necessary machinery heavy, cumbersome and expensive. It is, however, simple, accurate and speedy. The various applications of electric welding in commercial practice can be subdivided as follows: There is first plain butt welding, or the welding end-to-end of bars and the like of the same or approximately the same area. A variation of the plain butt welding is the angle, tee and miter welding, which is used on both rectangular bars and various sections of profile iron. Spot welding takes the place of riveting in such a way that only a small percentage of the total area in contact is welded together in circular spots. A development of spot welding is seam welding, in which the two sheets are joined together in an uninterrupted lap weld under one or between two rotating disk electrodes. Some figures are added on the strength of electric welds. Mild steel is most suitable for electric welding. Higher carbon steel can be welded up to about 0.8 per cent carbon, but the results are not so satisfactory as in mild steel as regards either the tensile or the torsional strength. Pure copper welds quite satisfactorily, and so do most of the brasses unless the percentage of zinc in them is too high, when the weld becomes brittle and will not draw. Nickel and most of its alloys weld very well, as do also aluminum, silver, gold, platinum and iridium. These remarks apply, however, only to butt welding, as iron and mild steel are the only materials that lend themselves to spot welding in a satisfactory manner. E. W. Marchant said in the discussion that the energy consumption is remarkably small, as is seen from the fact that a weld between a pair of 5/32-in. rods takes 20 watt-minutes, or in other words 1000 welds of this kind can be made with only 0.33 kw-hr. It is interesting to note that as the diameter of the rod increases the energy consumption per weld goes up very rapidly; for example, comparing 5/32-in. and 5/16-in. rods, nine times as much energy per weld is required in the latter case. This increase is due partly to the increased contact area and also to the large amount of cooling due to the jaws holding the metal. The current used in the case of the 5/16-in. rods was about 2000 amp. Experiments showed that using copper rods a current of 6000 amp was required against 2000 amp for iron of the same diameter.—London *Electrician,* Feb. 21, 1913.

Book Reviews

LIGHT, PHOTOMETRY AND ILLUMINATION. A thoroughly revised edition of "Electrical Illuminating Engineering." By William Edward Barrows, Jr. New York: McGraw-Hill Book Company. 335 pages. Illus. Price, $3 net.

An excellent textbook of the most recent illuminating engineering principles, designed for the use of students of photometry and illumination. It is well arranged and illustrated. The descriptions are brief yet clear. The subject is brought up to date in many directions to a remarkable degree considering how many lines of work are covered and how difficult it is to keep informed on all of them. Although the book is principally addressed to students in colleges, yet it will be of much service to illuminating engineers and all who are interested in illuminating engineering. It is, we believe, one of the best modern books on the subject in the English language.

DIE BELEUCHTUNG VON EISENBAHN-PERSONENWAGEN. By Max Buttner. Second edition. Berlin, Germany: Julius Springer. 236 pages, 108 illus. Price, 7 marks.

A thoroughly good and comprehensive treatise on the subject of car lighting, a special subject which is assuming greater and greater importance. Starting with a short historical review which goes back as far as 1836, the author goes on to explain the lighting of cars by means of oil and gas, including the latest developments in this line since the introduction of the incandescent gas mantles. This forms the first part of the book. The second part is given over entirely to electric lighting. Practically every known electric system of car lighting, European as well as American, is described in detail, its applications are enumerated and its advantages and disadvantages explained. The book ends with a chapter containing statistics and comparative statements of cost of operation for the different lighting systems. The book is clearly written, well illustrated and should prove of interest to those engaged in car lighting both here and abroad.

THE THEORY OF LIGHT. A treatise on physical optics. By Richard C. MacLaurin. In three parts. Part I. New York: G. P. Putnam's Sons. 326 pages. Illus. Price, $2.75.

A mathematical treatise on physical optics written with great care. The scope of the book is to present the theories of optics, especially as developed by Green and MacCullagh, in such a manner as to reveal the differences between theory and experiment. The treatment is essentially philosophical. The electromagnetic theory of light is barely outlined in this first volume, dependence being placed upon the mechanical or elastic solid theory. The chapters relate to the following subjects: Scope and method of inquiry; preliminary ideas; propagation of light in transparent media; influence of a layer of transition; transparent isotropic plates; propagation of light in transparent crystalline media; reflection and refraction with transparent crystals; transparent crystalline plates; propagation of light in absorbing isotropic media; Newton's rings formed by metallic reflection; propagation of light in absorbing crystalline media. The book will be of great interest to advanced students of mathematical physics and optics.

New Apparatus and Appliances

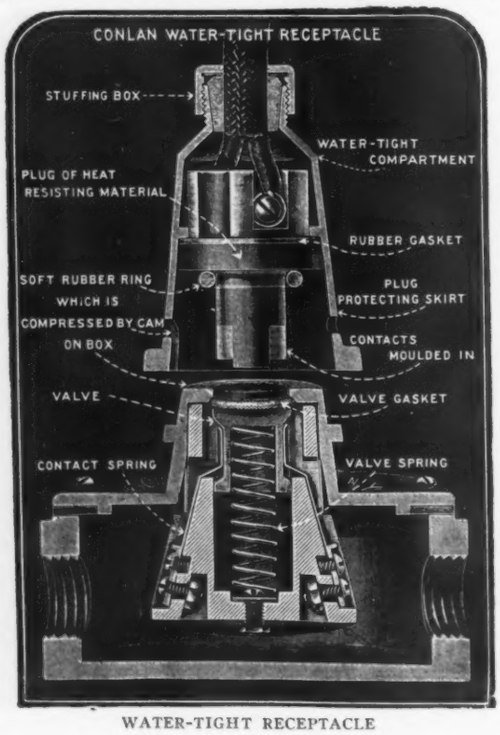
An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Portable Electric Lamps of Pottery

One exhibit at the recent Clay Products Exposition in Chicago was of some interest to electrical men, as it embraced portable electric lamps in various artistic designs, in which both the standard and the shade were made entirely of pottery. These all-clay lamps were shown by the Vasekraft Studio of the Fulper Pottery Company, of Flemington, N. J. This company is said to have been in operation since 1805. The "Vasekraft" wares depend on the colors and texture of glazes to ornament the pottery shapes rather than the modeling in relief on the shape itself. Various designs of portable lamps were shown and the shapes, while usually, perhaps, more ponderous than dainty, were in many cases decidedly novel and artistic. The colors shown in the pottery vases, shades and bowls were generally beautiful and pleasing.

Water-Tight Plug Receptacle

The water-tight plug receptacle shown in the accompanying illustration has been introduced by the Conlan Electric Company, 43 Murray Street, New York City. Instead of the portable lid for covering the opening disclosed by the removal of the plug an automatically operated valve is employed. The action of the valve spring is also utilized to produce a quick break in the electrical circuit when the plug is removed. Another feature of this apparatus is found in the use of a cam for connecting the plug to the box. This cam compresses a gasket between the plug and the face of the box which makes the joint water-tight. The gasket is attached to the base of the plug. The operator, who is usually unskilled, is not required to do more than break the electrical connection and the receptacle is automatically rendered water-tight. This device is well adapted for use on shipboard, by railroads or in mines, breweries, garages or theaters.



WATER-TIGHT RECEPTACLE

Choke Coils and Disconnecting Switches

The choke coil and disconnecting switch illustrated herewith are typical of a new line of such devices recently brought out by the Electric Service Supplies Company, Philadelphia.

The bases of both choke coils and disconnecting switches are of standard 3-in. channel iron, which permits the devices to be attached to switchboards directly, to cross-arms, poles, pipe or any other suitable supporting means.

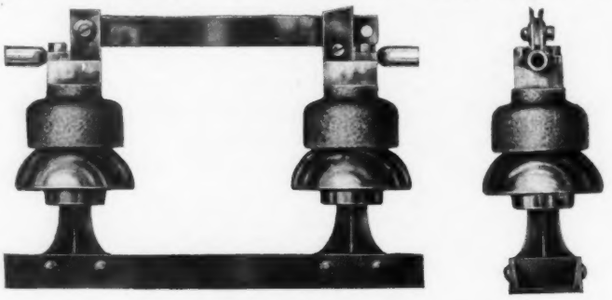


FIG. 1—CONSTRUCTION OF DISCONNECTING SWITCH

The pin insulators are supporting galvanized-iron tops, to which are attached brass terminal blocks for either the choke coil or the switch mechanism.

Choke coils are sweated into these blocks and provided with separable terminals. The manufacturers claim that these choke coils are very rugged in construction, possess great electrical and mechanical strength, and that their design has been worked out so that they afford great protection to electrical apparatus when used in conjunction with their standard types of arresters, known as Gorton-Daniels lightning arresters. The choke coils are made for ratings up to 23,000 volts and for all standard current ratings.

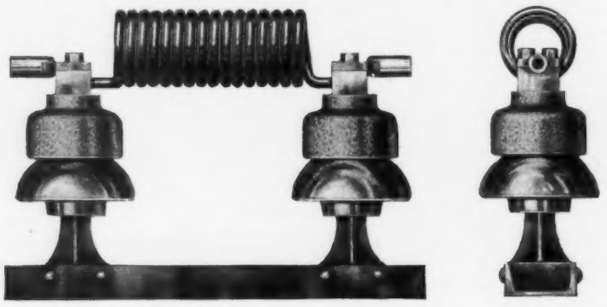


FIG. 2—CONSTRUCTION OF CHOKE COIL

In the disconnecting switch the clips are made of machine-finished, pure, hard-drawn copper. The blades are hung in the clips, and tension screws are provided at each end to secure proper contact. Separable terminals are provided on these switches for all ratings.

High-Tension Air-Break Switches Under Severe Winter Conditions

In order to obtain some accurate knowledge as to the behavior of high-tension air-break switches under severe winter conditions some experiments have recently been made under conditions resembling those of a severe sleet storm. In Fig. 1 is shown a three-pole switch manufac-

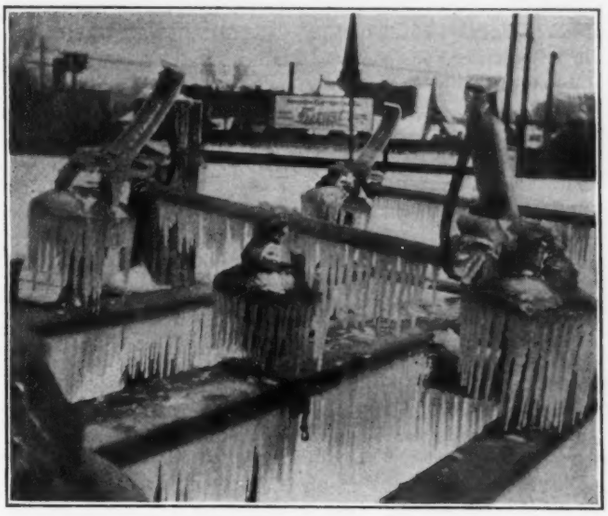


FIG. 1—TWO POLES OF A THREE-POLE WEATHER-PROOF HIGH-TENSION AIR-BREAK SWITCH

tured by the Delta-Star Electric Company, Chicago, Ill., mounted on a temporary structure. With a temperature of 25 deg. above zero and wind velocity of 25 miles per hour as recorded by the Weather Bureau, a heavy spray of water was directed on the switch for about two and a half hours. The ice deposit was very heavy and resulted in long icicles extending from the insulator petticoats to the channel-iron switch mounting. The operating mechanism connecting the three rotating switch arms is located within the central channel-iron mounting base and therefore was not affected by the ice formation.

Under the conditions illustrated, the flash-over occurred at potentials from approximately 51,000 volts to 57,000 volts. The value varied as the voltage was raised and the icicles began to melt. During the test a spray of water was played on the switch, thus keeping the ice wet. The combination of ice formation, thawing icicles and steady water drizzle was probably equal to the worst conditions.

After the break-down or voltage tests were completed the switches were operated by closing and opening the swinging arms, thus breaking the ice at both the main and auxiliary contacts. Fig. 2 shows the action of the main and arcing contacts. The main contact was opened, the arcing contacts still remaining in circuit and in position to take the arcing or burning incident to final opening. Obviously the problems of carrying capacities, voltage, break-down clearances, etc., are relatively simple, as they depend simply on spacing, size of contacts and the type of insulator used. The real problem in outdoor switches is to adopt a construction which will meet the conditions as presented by severe winter service.

Display Stand for Electric Goods

The Rochester Stamping Company, Rochester, N. Y., has designed a very practical display stand which is furnished to the trade with its electric household goods. It measures about 56 in. in height and is made of steel castings sufficiently heavy not to tip over. It is finished in aluminum and provides space for nine articles. By a simple screw arrangement the goods are fastened on the brackets so that they cannot be knocked off but are readily released by a twist of the thumb.

Motor-Driven Mixer and Beater

The use of machines driven by small individual electric motors has proved a great source of economy in bakeries, confectionery plants, hotels and restaurants. One such application of a beater and mixer is illustrated herewith as a typical example of these time-saving and labor-saving devices. This machine is applicable to all classes of plain and fancy cake, biscuit and egg work, fruit and other pie fillers, jams, jellies, sauces, dressings and other preparations of the numerous varieties that require mixing and mashing.

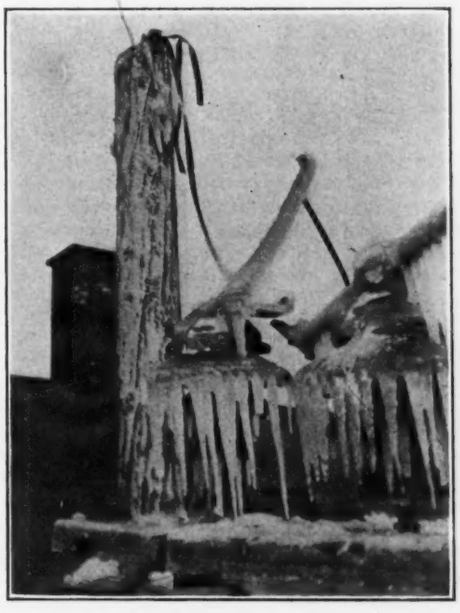
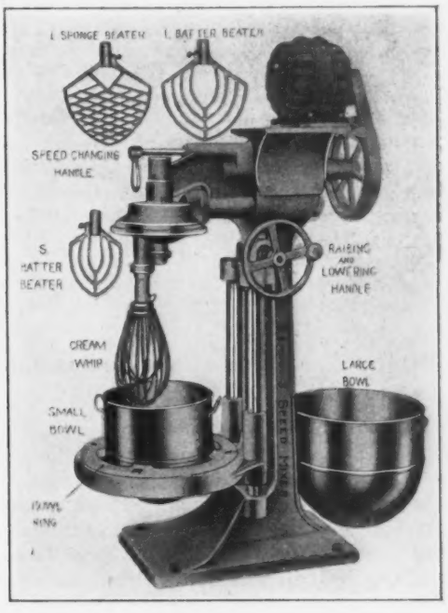


FIG. 2—MAIN AND ARCING CONTACTS OF SWITCH

DISPLAY STAND



MOTOR-DRIVEN DOMESTIC APPLIANCE

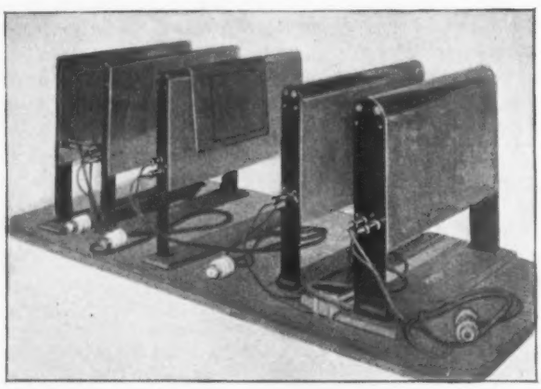
The beating bowl rests on a stand which can be raised to the beater by turning a handle. A variety of styles and sizes of paddles can be supplied for the machine, and one of these patterns can easily be replaced by another one if desired.

The machine has three speeds and is controlled by turning the speed-changing handle. The machines are made by the Read Machinery Company, York, Pa., the electrical equipment being furnished by the Westinghouse Electric & Manufacturing Company.

Electric Forming Irons for Bookbinding

The Prometheus Electric Company, of 236 East Forty-third Street, New York, has placed on the market an electrically heated forming iron for use in binding books. Unlike the steam pipes and other devices that are commonly employed for this work, these irons are portable. The curved working surfaces are 18 in. long and the tool stands 15 in. high. The curved tops have correct diameters to fit the sizes of books to be formed.

In the use of these forming irons heat is applied at the top only and none of the annoyances which are usually associated with fuel heating is present. The working surface of the heater is made of nickel-plated cast iron, the end frames are of black japanned wrought iron, and the sides are of Russia iron. The apparatus is mounted on a slate base. Each heater is equipped with a 6-ft. cord for connecting it to a lamp socket. The cord is removable at the heater. The heating units are built in sizes which will consume from 90 watts to 180 watts.



ELECTRIC FORMING IRONS

Electric Apparatus at the Boston Automobile Show

The Boston Automobile Show, for pleasure cars only, was opened at the Mechanics' Building, Huntington Avenue, Boston, Mass., on the evening of March 8, to last one week, and was characterized by a representative display of the latest models of gasoline and electric machines, ranging in character from the motor cycle to the highest powered and most luxurious touring cars. There were about 300 exhibitors, including accessory manufacturers and dealers. The use of electric self-starting methods and electric lighting has become standard practice with the makers of the highest grades of gasoline cars. The electric automobile display is somewhat scattered this year at Boston, but contains many admirable examples of the brougham and roadster types of equipment. One of the latest models shown, which has been brought out since the New York and Chicago exhibitions earlier in the season, is a new roadster built by S. R. Bailey & Company, of Amesbury, Mass. This machine, known as the company's Model "F," is said to give 125 miles per charge at an average speed of 20 miles per hour, the maximum speed being in the neighborhood of 27 miles per hour.

The Anderson Electric Carriage Company, Detroit, Mich., is showing a roadster equipped with a new auxiliary seat, foot rest and the latest type of sectional windshield.

The Woods Motor Vehicle Company, Chicago, is showing a new arrangement of a Sangamo ampere-hour meter designed to indicate the ampere-hours left in the battery at a stated rate of discharge, an odometer being installed in the same case. The body is also designed to facilitate an outlook toward the rear, the makers having found this a feature hitherto rather lacking in some designs of pleasure cars with closed bodies.

The Champion Ignition Company, Flint, Mich., is showing a new spark plug with extra long porcelain core protruding slightly below the end of the metal shell and permitting the use of a very short center electrode, which it is contended will not overheat or get out of adjustment, thereby insuring a smoothly running motor. The extra length of insulation makes it practically impossible for soot to short-circuit the plug.

The Arnold Electric Company, Boston, Mass., is showing a new electric vaporizing coil for starting cold motors of the gasoline type. The coil requires 9.5 amp at 6 volts for about one minute and is applicable to either automobiles or motor boats.

The Electric Storage Battery Company, Philadelphia, is showing a full line of "Exide" plates of the latest design, views of its factories and working demonstrations of the power requirements of car lighting and self-starting.

The Waverley Company, represented by the J. W. Bowman Company, Boston, is showing a new model electric limousine, with a divided rear seat giving three spaces for passengers and providing greater comfort, together with room for parcels behind the seating spaces.

The Underhill Company exhibits the Grinnell car, in the form of a five-passenger brougham with a three-position folding swivel seat at the right of the operator. The car has low front windows affording an easy view of the road. A Hupp-Yeats electric limousine with driver's seat completely incased is also being exhibited at the show and is attracting considerable notice.

The Locomobile Company of America displays a new electrically operated starter of its own build mounted on the engine base to provide for the constant alignment of the driving gears. The starter is operated by a switch controlled by the starting pedal of the car. The electric motor starter is designed to give a high acceleration and starting torque for the short period in which its operation is required.

Among the other exhibitors of electrical interest, whose displays also appeared at the New York and Chicago shows, are the Edison Storage Battery Company, West Orange, N. J., which is featuring the cell groups required in specific pleasure car and truck service; the American Storage Battery Company, Cambridge, Mass.; Burn-Boston Battery & Manufacturing Works, Boston, Mass.; Buffalo Electric Vehicle Company, Buffalo, N. Y.; Connecticut Telephone & Electric Company, Meriden, Conn.; Columbia Motor Car Company, Hartford, Conn.; Diamond Rubber Company, Akron, Ohio; Joseph Dickson Crucible Company, Jersey City; Dodge Motor Vehicle Company, Cambridge, Mass.; Gray & Davis, Boston, Mass.; Heinze Electric Company, Lowell, Mass.; Holtzer-Cabot Electric Company, Brookline, Mass.; Marburg Brothers, Inc., New York; Pittsfield Spark Coil Company, Dalton, Mass.; Rauch & Lang Carriage Company, Cleveland, Ohio; Simms Magneto Company, New York; Splitdorf Electrical Company, Newark, N. J.; United States Light & Heating Company, New York, and Willard Storage Battery Company, Cleveland, Ohio.

The Boston motor truck show will open in the Mechanics' Building on March 19.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Demand for Electrical Supplies Feature of Western Electric's 1912 Business.—As was stated in these columns Jan. 8, the total sales of the Western Electric Company in 1912 were over $71,000,000, the largest total in the history of the company. Contrary to general belief, this record was not due to the expansion of the company's business in telephone equipment, but chiefly to a large increase in the demand for electrical supplies such as incandescent lamps, dry batteries, fan motors, iron conduit pipe, copper wire, motors, generators, etc. This branch of the company's business doubled from 1906 to 1912 and in 1912 was four times as large as in 1900. Throughout 1912 each month's business was larger than that in any corresponding month in the history of the company. Vice-president Swope, discussing the policy of the company, said this week: "With the increasing use of the telephone and other things electrical, our opportunity is constantly broadening. With study and care as to our methods we should constantly become more efficient, thus deserving the opportunity to serve the community more largely, and by keeping before us the time-tried principles, retain the confidence, respect and patronage of an ever larger number of satisfied customers. With many companies, and indeed partly with our own, in the past, patents have been the basis largely responsible for their growth and success. With us, more and more, patents are useful principally in that they give us greater freedom to develop the best system. Our plan is to develop the best form of apparatus for its purpose, to manufacture it with reference to low cost of maintenance and to sell it on the basis of quality and price. We cannot expect to sell at the same price or a better price than our competitors unless our product is as good or better than theirs. Therefore, 'quality' must be present, must be talked and must be considered to get a share of the business."

Central-Station Service for Panama-Pacific Exposition.—A contract was signed on March 5 between the Panama-Pacific International Company and the Pacific Gas & Electric Company under which the latter will supply exclusively during the next three and one-half years all electrical energy required for motors and lighting during the term of the World's Fair in San Francisco in 1915 and during the period of construction and dismantling. The present estimates indicate that the exposition will require 20,000 hp. The gross amount of this business is estimated at $500,000. Simultaneously contracts were entered into with the Pacific Gas & Electric Company for all gas and steam required by the exposition. The vice-president of the company believes that this is the first time that an exposition of the first magnitude has been able to contract for all its requirements for electrical energy with a single company. The Pacific Gas & Electric Company now has in operation electric generating stations with an equipment rating exceeding 200,000 hp, and it is engaged in the construction of several additional hydroelectric plants with an ultimate rating of 165,000 hp, which when completed will give it a total electric generating rating of 365,000 hp.

Westinghouse Had Record Year Despite Low Prices.—For the fiscal year ended with the current month, the Westinghouse Electric & Manufacturing Company will show a record in gross earnings. These will be between $40,000,000 and $41,000,000, comparing with $38,119,312 in 1911, the best previous showing. It is understood, however, that the net earnings will not show a proportional increase, although there will be a surplus of about 8 per cent on the common stock available for that issue after payment of the regular 7 per cent dividend on the preferred. The present rate on the common is 4 per cent, and it is unlikely that the directors will make any change in the rate during the present calendar year. While there was considerable activity in the electrical trade last year and many electrical manufacturing companies enjoyed large increases in their gross earnings, the net profits were not in the same proportion, as was brought out in the canvass made by the *Electrical World* toward the close of 1912. Selling prices for electrical equipment were low during the year and competition was exceedingly severe, while prices for raw materials increased.

General Electric to Make Diesel Engines.—In a note in these columns Feb. 8, 1913, discussing the increase in the number of manufacturers now making crude-oil engines of the Diesel type, we said that one of the largest electrical manufacturers was also about to go into the Diesel-engine-building field. That statement referred to the General Electric Company, which is now developing one or two small sizes of Diesel engines at its works at Erie, Pa. The entire project is still in the formative stage, and the extent to which the company will enter the field, as well as the sizes to be built, will depend in a large measure upon the results obtained from the engines now in course of construction. The General Electric Company has been in touch with Mirlees, Bickerton & Day, who are building Diesel engines in Stockport, Eng., and will probably make an arrangement with that concern whereby it will be able to secure the benefit of its shop experience, designs, patterns, etc.

Slight Decrease in Copper Surplus.—The comparative statements of the Copper Producers' Association for January and February will be found on page 591. The February statement, issued March 8, showed stocks on hand of March 1 of 122,302,198 lb., as compared with 123,198,332 lb. on Feb. 1, a decrease of only 896,134 lb. This reduction is noteworthy, however, in view of the fact that domestic deliveries last month were lower than in any month last year with one exception. The explanation of the decrease in stocks is found in a falling off in production as compared with January and in an increase in foreign deliveries. Export sales were greatly stimulated by the recent price reductions, with the result that copper exports last month were larger than those in any other month since the beginning of 1912.

Southern Power Company Orders 1500-Volt Converters.—The Southern Power Company, of Charlotte, N. C., which up to the present time has operated its 1500-volt direct-current railway system from motor-generator sets, the two generators of each set being connected in series, has placed an order with the Westinghouse Electric & Manufacturing Company for three sets of 750-volt, 60-cycle rotary converters. The rating of the rotary sets will be 500 kw and each set will comprise a double converter on a single bedplate, the two interpole machines being connected in series. The machines will be installed in the Spartanburg (S. C.) station and will be the first units of their kind built.

New Home for Edison Enterprises.—Thomas A. Edison's business enterprises in Chicago will be concentrated in one building devoted exclusively to that purpose. This is a four-story building at 229 South Wabash Avenue, with an attractive front of white enameled brick. It is known as the Edison Phonograph Building. It contains or will contain the Chicago offices of the new Phonograph Company, Edwin C. Barnes & Brothers, local representatives of the dictating-machine department of Thomas A. Edison, Inc., the primary-battery department of Thomas A. Edison, Inc., and the Edison Storage Battery Company.

Alabama Interstate Interests Elected to American Cities Board.—James Mitchell and W. W. Freeman, president and vice-president of the Alabama Interstate Power Company, and Irving P. Bonbright have been elected directors of the American Cities Company, New Orleans, succeeding William Von Phul, of New Orleans; William P. Bonbright, of New York, and Lynn H. Dinkins, of the first-named city.

Electrical Compared with Railroad and Industrial Earnings and Failures.—Several charts showing the relative security of certain classes of stocks and bonds and the relative steadiness and rate of increase in the net earnings of some of these classes have been prepared by Henry L. Doherty & Company. These charts are similar to those which were described in the *Electrical World* Dec. 30, 1911, page 1621, and were prepared by the same company. The first chart shows, year by year, for ten years how the gross and the net earnings increased and decreased for typical gas and electric companies, electric street railways, steam railroads and the large industrial companies listed on the New York Stock Exchange. The curve for the electric properties indicates that the earnings of these companies have increased steadily and rapidly, while the earnings of the industrials and the steam roads have fluctuated. A second chart shows the result of analysis for the thirty years from 1882 to 1911, indicating the percentage of capital in the hands of receivers as compared with the total capital of each group. The aggregate amount of capital considered in this chart is $545,310,371,443, of which $9,578,713,793 was found to be insolvent, this being an average for the whole of $1.75 out of every hundred dollars of stocks and bonds outstanding. Based on figures of all the gas and electric companies in the United States, it was found that an annual average of only 37 cents out of every $100 of all gas and electric stocks and bonds has been in the hands of receivers, as compared with a total of $1.93 per $100 for national-bank capital, $1.84 for steam railroads and $2.07 for industrial corporations. In the case of the national banks the figures showed that an annual average per $100 of securities outstanding of 32 cents has been declared insolvent by the government and that $1.61 in addition has been voluntarily liquidated, making a total of $1.93 as above. From the data the compilers deduce that gas and electric companies are about five times as free from receiverships as are steam railroad securities and that they are over five and one-half times as free from receiverships as are the larger industrial companies.

Emergency Central-Station Service for the Corn Products Company.—On Feb. 26 a 2000-kw steam turbine in the private plant of the Corn Products Company at Argo, near Chicago, broke down. This turbine operated a 600-volt, 25-cycle, three-phase generator from which electricity was obtained to operate a large number of electric motors throughout the works. In the emergency the Public Service Company of Northern Illinois was appealed to. This company has a 33,000-volt transmission line passing near the Argo plant and an extension was made from this transmission line to a temporary substation building at the power house of the Corn Products Company. The 33,000-volt transmission line is protected by a ground wire, but in the emergency extension choke coils were inserted where the connection was made with the main transmission line, and units consisting of a disconnecting switch, S. & C. fuse, choke coil and spark gap were put in outside the substation. This extension supplied energy to a 750-kw oil-insulated, water-cooled three-phase transformer, which stepped down the emf from 33,000 volts to 460 volts. By this means a temporary supply of 460-volt, 60-cycle energy to the amount of about 750 kw was obtained. It was necessary, however, to change the motors so that this energy could be utilized. About a week's time was consumed in making the temporary connection, but had it not been for the fact that a bad sleet storm was encountered while the work was going on the work could have been done in a much shorter time.

Will Sell Chicago Properties of Allis-Chalmers Company April 8.—In pursuance of a decree entered in the United States District Court for the Northern District of Illinois, the Chicago properties of the Allis-Chalmers Company will be sold on April 8. The properties consist of two works. The bids must be accompanied by $150,000 in cash or $300,000 in bonds. Judge F. A. Geiger, of the United States District Court, on March 7 denied the motions of the dissenting stockholders and bondholders of the Allis-Chalmers Company and affirmed the sales of the Milwaukee real property and all personal property of the company for a total of $6,250,000 on condition that the sales of the real property in other states make the total purchase price enough so that the bondholders may realize 62½ cents on the dollar. The dissenting stockholders claimed that the real property, which was sold on Feb. 3 for $2,250,000, should have brought $3,750,000, on the assessed valuation of the property. They also contended that the personal property should have brought $7,000,000 instead of $4,000,000, and based their argument on the recent inventory made by Otto H. Falk, the receiver.

Gas-Engine Sales.—The Wheat's Ice Cream Company, Buffalo, N. Y., has placed an order with the Bruce-Macbeth Engine Company, Cleveland, Ohio, for a 90-hp engine, which makes the seventh engine of the same make in use by that company. The following installations have been made recently in Cleveland alone by the Macbeth company, in addition to seventy other installations previously made in the same city: The Grabler Manufacturing Company, 150 hp; H. C. Tack Company, 150 hp; Willard Storage Battery Company, 150 hp; Frost Wire Fence Company, 90 hp; Cooper Spring Company, 60 hp; Guide Motor Lamp Company, 40 hp; Ranney Fish Company, 40 hp; Tinnerman Steel Range Company, 40 hp. The Willard Storage Battery Company's order, a 150-hp engine, makes the fifth engine of the same manufacture in use by that company.

New Officials for Pacific Telephone & Telegraph Company.—A number of important changes in the list of officials of the Pacific Telephone & Telegraph Company, San Francisco, were announced last week, following the annual meeting. Louis Glass and E. J. Zimmer, vice-presidents and directors, resigned and were succeeded by J. M. Quay and H. D. Pillsbury. E. C. Bradley resigned as vice-president and general manager but continues as a director. His successor was not named. G. E. McFarland, of Omaha, vice-president and general manager of the Nebraska Telephone Company, is to be president of the Pacific Telephone & Telegraph Company, and H. T. Scott chairman of the board of directors.

Direct-Current Locomotives for Southern Power Company.—The Southern Power Company, of Charlotte, N. C., which supplies the electrical energy to the Piedmont & Northern lines and other affiliated interests, has placed an order with the General Electric Company for six 60-ton locomotives for operation on the 1500-volt direct-current overhead-trolley interurban line connecting Charlotte and Gastonia, N. C., and which also operates over a stretch of territory in South Carolina. This system when completed will be one of the largest electric freight and interurban roads in the country and will extend from Greenville, S. C., to Charlotte, N. C., with possible extensions far beyond these limits.

Salida (Col.) Utility Properties Sold.—The reorganization committee of the Central Colorado Power Company has purchased the Salida (Col.) Light, Power & Utility Company, which is one of the oldest hydroelectric developments in Colorado. The purchase price is given as $500,000. The Central Colorado Power Company is to be sold at a receiver's sale in Denver on March 31, and will be bid in by the reorganization committee for the bondholders of the Central Colorado and the Leadville Light & Power companies. The generating system at the Salida company consists of two hydroelectric plants of about 1000 hp each. These are capable of development to 12,000 hp.

Several Large Electrical Companies Organized in February.—With few exceptions, the largest companies incorporated in the Eastern States in February were public-service enterprises. Some of those taking out charters last month were the Colorado Mines, Railways & Utilities Corporation, $25,000,000; American Railways Company of Delaware, $25,000,000; Kootenai Falls Power Company, $11,000,000; Louisville Gas & Electric Company, $18,000,000, and the United States Public Service Company, $10,000,000, all of Delaware. The Toledo Traction, Light & Power Company, $17,000,000, took out a charter in Maine.

General Electric Presidency.—New York newspapers contained advices from Schenectady this week indicating that C. A. Coffin, president of the General Electric Company, will retire shortly and that E. W. Rice, Jr., vice-president, will succeed to the presidency. Mr. Coffin is now in his seventieth year, and it is said that he is desirous of retiring from active duties. Well-informed representatives of the company would neither confirm nor deny the truth of the rumor this week.

New Company's 1913 Construction Requirements Total $1,386,000.—The Eastern Power & Light Corporation has been incorporated under Virginia laws to take over and operate a number of electric lighting and traction properties in New England, Pennsylvania, West Virginia and Indiana. Its officers are as follows: President, W. S. Barstow; first vice-president, Joseph B. Taylor, both of W. S. Barstow & Company, 50 Pine Street, New York; second vice-president, G. H. Walbridge, of William P. Bonbright & Company, and secretary and treasurer, A. P. Taliaferro, also of the same concern. These, with the following, are the directors: F. V. Henshaw, of William P. Bonbright & Company; Henry E. Cooper and A. Ludlow Kramer, of the Equitable Trust Company, New York. The authorized capitalization of the new company consists of $10,000,000 preferred stock, of which $2,350,000 is to be issued immediately, and $10,000,000 common stock, of which $5,000,000 is to become outstanding at this time. The preferred stock is to receive dividends at the rate of 6 per cent until March 1, 1916, and then at 7 per cent, and is also to be redeemable after that time at 125. In addition, $2,350,000 five-year 5 per cent convertible gold bonds are authorized, all of which are to be outstanding at once. The New England properties which have been taken over by the Eastern Power & Light Corporation are the Claremont (N. H.) Power Company and the Claremont Railway & Lighting Company, the Clarendon (Vt.) Power Company and the Colonial Power & Light Company of Vermont, which includes the Manchester (Vt.) Light & Power Company and the electric department of the manufacturing concern at Springfield, Vt., now serving that community with electrical energy. The Pennsylvania properties taken over by the new company are the Reading Transit Company, including the United Traction Company, the Lebanon Valley Street Railway Company, the Edison Electric Illuminating Company of Lebanon, and the Schuylkill Valley Traction Company, together with the twenty-four subsidiaries of the last four companies. In West Virginia the Eastern Power & Light Corporation will control and operate the West Virginia Traction & Electric Company, of Wheeling, W. Va., which is a consolidation of nearly all the public service properties in that city and in Morgantown, W. Va. The Indiana properties taken over by the newly organized company are the City Electric Lighting Company, of Vincennes, Ind., and the Vincennes Electric Company. The construction requirements of the Eastern Power & Light Corporation for 1913 call for a total expenditure of $1,386,000. With $350,000 of this the company is to install a hydroelectric station rated at about 3000 hp on the Mill River, Vermont, at Clarendon, and energy will be supplied from this plant to Clarendon, Cavendish, Springfield and Manchester, Vt., and to Claremont, N. H., as well as to intervening communities. It is also planned to spend $786,000 on the system of the Reading Transit Company and $250,000 in West Virginia.

Will Engage in Transmission Line Work.—The Transmission Engineering Company has been organized in Pittsburgh to do special transmission-line work. The new concern is affiliated with the Railway & Industrial Engineering Company, manufacturer of the Burke horn-gap apparatus, and is making a specialty of outdoor steel substations and special work for terminal towers, station outlets, railroad crossings and similar requirements. Its officers are: H. L. Patterson, president; G. N. Lemmon, vice-president and general manager, and B. W. Kerr, secretary-treasurer. A. W. Burke is its consulting engineer.

Convention of the H. W. Johns-Manville Company.—About forty representatives of the H. W. Johns-Manville Company from various parts of the United States, Canada and Mexico met in an annual convention held at the Congress Hotel annex in Chicago on March 10-15, inclusive. J. E. Meek, general railroad manager of the Chicago office, presided over the convention. The papers and discussions dealt with general sales policies, improved methods of train-board lighting, illumination of railway stations and platforms and insulating materials.

Planning to Consolidate Florida Utilities.—A number of bankers and capitalists prominent in the public utility field are touring Florida in a special train for the purpose of inspecting a number of electric-lighting and ice plants in that State with a view to merging these into one concern, which will probably be known as the Southern Utilities Company. About twenty-five such properties have been acquired in the past ten days.

Form Partnership to Manufacture Electrical Supplies.—James T. Hickey and John Schneider, who resigned their respective positions as inspecting engineer and factory superintendent with a New York concern a short time ago, have formed a partnership and will engage in the manufacture of transmission-line supplies at Elizabethport, N. J.

Westinghouse Machine Plants Busy.—According to advices from Pittsburgh, the Westinghouse Machine Company booked a total of $1,100,000 of business during February. The company's shops are well occupied with new work, and the outlook for still further improvement in the immediate future seems very promising.

Building New Station at Spartanburg, S. C.—The South Carolina Light, Power & Railways Company, which is the successor of the Spartanburg Railway, Gas & Electric Company and the Electric Power & Manufacturing Company, is building a new 10,000-kw station.

February Statement of Copper Producers' Association

The February statement of the Copper Producers' Association, issued on March 8, showed a decrease of 896,134 lb. in surplus stocks and compared with the January statement as follows:

	February, pounds		January, pounds	
Stocks on hand in the United States on first of month		123,198,332		105,312,582
Production		130,948,881		143,479,625
		254,147,213		248,792,207
Domestic deliveries	59,676,492		65,210,030	
Foreign deliveries	72,168,523		60,383,845	
		131,845.015		125,593,875
Stocks on hand at the end of month		122,302,198		123,198,332

NEW YORK METAL MARKET PRICES.

	March 4 Bid.	March 4 Asked.	March 11 Bid.	March 11 Asked.
Copper:				
Standard, spot	14.37½	14.75	14.37½	14.75
	£ s d		£ s d	
London, standard, spot	66 0 0		65 5 0	
Prime Lake	14.87½	to 15.00	14.90	to 15.00
Electrolytic	14.85	to 14.95	14.85	to 14.95
Casting	14.70	to 14.80	14.70	to 14.80
Copper wire, base	16.00	to 16.25	16.00	to 16.25
Lead	4.35		4.35	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	8.25		8.25	
Spelter, spot	6.35	to 6.45	6.40	to 6.50
Tin, spot	47.75		46.25	
Aluminum:				
Prompt delivery	25.50	to 26.00	25.50	to 26.00
Future	25.50	to 26.00	25.50	to 26.00

OLD METALS.

Heavy copper and wire	13.50	13.62½
Brass, heavy	9.00	9.00
Brass, light	7.75	7.75
Lead, heavy	4.15	4.15
Zinc, scrap	5.12½	5.12½

COPPER EXPORTS IN MARCH.

Total tons to March 12	15,573

Industrial Securities

Security	Capital Stock Listed	Dividend Per Cent	Dividend Period	Quotation Mch. 5	Quotation Mch. 12
Allis-Chalmers, t.r., 3d pd	$15,501,800	.....	.....	3	3¼
Allis-Chal., pf., t.r., 3d pd	14,105,500	.....	.....	9¼*	9
Amalgamated Copper	153,887,900	1¼	Q	72⅝	69⅝
American Tel. & Tel.	344,046,700	2	Q	132¼	132¼
Electric Storage Battery, c.	16,074,425	1	Q	52	51
General Electric	101,203,500	2	Q	139	138
Mackay Cos., c.	41,380,400	1½	Q	83*	83*
Mackay Cos., pf.	50,000,000	1	Q	67	67½*
Western Union Tel.	99,745,400	½	Q	68*	66⅞
Westinghouse, E. & M., c.	33,834,050	1	Q	70½	68½
Westinghouse, E. & M., pf.	3,998,700	1¼	Q	118	118*

*Last price quoted.

Personal

Mr. George W. Imhoff has resigned as assistant treasurer of the Port Arthur (Tex.) Light & Power Company.

Mr. Arthur L. Kelley, president of the Narragansett Electric Lighting Company, Providence, R. I., has beeen critically ill in Boston, where he is under the care of specialists

Mr. C. R. Bohannon has been appointed manager of the new-business department of the United Gas & Electric Company, which furnishes central-station service at both New Albany and Jeffersonville, Ind.

Mr. Rome C. Saunders has been appointed commercial agent for the Tacoma Railway & Power Company, Tacoma, Wash. Mr. Saunders was formerly connected with the Minneapolis General Electric Company.

Mr. Marshall E. Sampsell, of Chicago, president of the Central Illinois Public Service Company, a subsidiary of the Middle West Utilities Company, was elected president of the Illinois Electric Railway Association on March 7.

Mr. Henry W. Howard has resigned his position with the commercial department of the Washington Water Power Company, Spokane, Wash., to become commercial agent of the Des Chutes Power Company, operating in the towns of Prineville, Madras, Redmond, Culver and Metolius, Ore.

Mr. Chester B. Starbird, an electrical engineer of New York City, has joined Mr. Schuyler R. Schaff under the partnership name of S. R. Schaff & Company, and will open an office in the Paul Jones Building, Louisville, Ky., for the development, extension and operation of utility properties.

Dr. S. W. Stratton, director of the United States Bureau of Standards, Washington, D. C., has been elected a member of the Council of the Underwriters' Laboratories, Chicago, Ill. The council is made up of twenty-two leading engineers and experts of the United States and Canada, who serve without recompense and supervise the technical work of the institution.

Mr. J. F. McGuire has been appointed manager of the Consumers' Power Company at Minot, N. D., succeeding Mr. H. E. Brandli, resigned. Mr. McGuire has been connected with H. M. Byllesby & Company's new-business department for several years, most recently in the capacity of commercial manager of the Consumers' Power Company at Faribault, Minn.

Mr. Samuel Insull, of Chicago, will deliver an address before the Franklin Institute of Philadelphia on March 19, the subject being "The Production and Distribution of Energy." This paper will, in a measure, supplement Mr. Insull's address on "The Relation of Central-Station Generation to Railway Electrification," presented at a meeting of the American Institute of Electrical Engineers in New York on May 5, 1912, and discussed at the Boston convention of the Institute on June 26.

Mr. S. K. Colby, vice-president of Pierson, Roeding & Company, of San Francisco, Cal., has become associated with the firm of Allen & Peck, Inc., of New York City, which operates a number of electric-railway lines in New York State. Mr. Colby will continue his connection with the first-named concern. He was graduated from the Rensselaer Polytechnic Institute in 1894. Mr. Colby is a member of the executive committee of the American Electric Railway Manufacturers' Association and has been closely connected with electric-railway developments on the Pacific Coast.

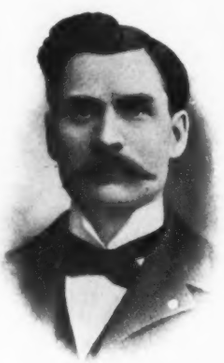
Obituary

Leopold Fishel, one of the organizers of the Babylon (N. Y.) Electric Light Company, died March 9, at the age of seventy-three.

Frank P. Ohmer, chief engineer for the Indiana & Michigan Electric Company, South Bend, Ind., dropped dead from heart failure March 3 while inspecting some of the machinery at the power plant. Mr. Ohmer was well known throughout the Middle West.

Harry T. Johnson, president of the Manhattan Electrical Supply Company of New York City, died Wednesday, March 5, at Daytona, Fla., whither he had gone several weeks before for a rest. The end came after a short illness, the immediate cause of death being blood disease. Mr. Johnson was fifty-two years of age and is survived by his wife and mother, the latter ninety-two years old. Twenty-five years ago Mr. Johnson and Mr. J. J. Gorman, then both young telegraph operators, established the company of which Mr. Johnson was president. From small beginnings the concern has grown until it now occupies a leading position among the manufacturing and supply firms of the country, operating three factories and five branch offices. Mr. Johnson was a member of the New York Athletic Club, Wellsville Lodge, No. 230, F. and A. M., Ancient Chapter No. 1, Palestine Commandery, and Mecca Temple.

Alfred Stromberg, who had been one of the conspicuous figures in the telephone manufacturing industry of the United States, died at his home in Chicago on March 8. Mr. Stromberg was born in Sweden on March 9, 1861. He was connected with the telephone industry from the early days, his first experience being gained with the great Ericsson establishment in his native country, by which he was first employed in 1878. In 1883 young Stromberg came to this country and obtained employment with the Chicago Telephone Company. While in its employ he made some improvements in apparatus, notably in the automatic hook switch, which were regarded as meritorious. Five years later Mr. Stromberg became connected with the Chicago Electric Protective Company, a concern which operated a burglar-alarm system in Chicago. Here, too, the young Swede's inventive talent was in evidence and he took out a number of patents relating to this business. It was largely due to his work that the business became a success. In 1893 the first of the fundamental Bell telephone patents expired, and Mr. Stromberg was one of the earliest to recognize the possibilities of the independent or competing telephone industry. He was employed by the Western Telephone Construction Company, of Chicago, one of the first independent manufacturers, and in 1896, associated with Mr. Androv Carlson, also a Scandinavian and a former fellow-employee of the Chicago Telephone Company, he organized the Stromberg-Carlson Telephone Manufacturing Company, of which he was made president. The business of this company was very successful almost from the start. It was based at first on the inventions and practical ideas of Stromberg and Carlson, but as the business developed a staff of designers was employed. The growth of the company was very largely due to Mr. Stromberg's great energy and the real genius he displayed in the design and manufacturing of telephone systems. The company was capitalized for $50,000, but in 1902 the business was sold out to a group of Rochester (N. Y.) capitalists for $750,000. The new owners retained the services of Mr. Stromberg for three or four years, but he gradually withdrew from the business and returned to Chicago. In that city he organized several years ago the Stromberg Electric Company, which manufactures electric time stamps, and he also was largely instrumental in the organization of the Stromberg Motor Devices Company, which makes carburetors and automobile accessories. Mr. Stromberg was a self-made man of great natural ability. He possessed a magnetic personality and was popular among independent telephone men. In business he was very shrewd, but he was not without a vein of mysticism, which did not usually affect, however, his great common sense in all the practical relations of life. He was a thirty-third-degree Mason, a Knight Templar and a member of the Union League Club of Chicago. He is survived by a widow and four children. While Mr. Stromberg had not been in perfect health for some time, death came rather suddenly.



ALFRED STROMBERG

Construction

ANNISTON, ALA.—The Ragland Wtr. Pwr. Co., of Ragland, has applied to the City Council for a franchise to supply electricity in Anniston. The company will get its power from lock 4 on the Coosa River, about 18 miles from Anniston. W. T. Brown, of Ragland, is president of the company.

RAGLAND, ALA.—Preparations are being made by the Ragland Wtr. Pwr. Co. for the construction of a hydroelectric power plant on the Coosa River, lock 4. The company proposes to raise the dam from its present height of 15 ft. to 18 ft. and ultimately to 22 ft. It is estimated that 10,000 hp can be developed, which will be transmitted to Ragland, Anniston and other cities. W. T. Brown, of Ragland, is president of the company.

ST. JOHNS, ARIZ.—A franchise has been granted to the Little Colorado Lt. & Pwr. Co. to erect transmission lines along certain highways in Apache County and on certain streets in the city of St. Johns.

GRAVETTE, ARK.—The commission has awarded the contract for construction of an electric-light plant and water-works system to A. J. Foster, of Joplin, Mo. Orders have already been placed for material for the proposed systems. The cost of the work is estimated at about $20,000.

WALNUT RIDGE, ARK.—The Public Service Utility Corpn. of Delaware is reported to have purchased a large block of stock in the Walnut Ridge & Hoxie Lt., Pwr. & Trans. Co. The new directors, it is said, propose to enlarge the plant at Walnut Ridge and take over the electric plants at Black Rock and Pocahontas and furnish electricity for lamps and motors in those towns.

BURBANK, CAL.—A special election will be held March 26 to vote on the proposition to issue $20,000 for the installation of a municipal electric-light plant.

FULLERTON, CAL.—Bids will be received by the Board of Trustees of Fullerton for the construction of a large electrically operated pumping plant for the municipal water-works system. Sloan & Robson are engineers.

GRIDLEY, CAL.—The Pacific Gas & El. Co., San Francisco, has purchased from the city the electric distributing system, consisting of several miles of wires and poles located outside of the city limits. The Board of Trustees has decided to abandon the plan of supplying energy outside of the city.

HANFORD, CAL.—The H. G. Lacey Co., which has recently completed an extension of its transmission line to the Eucalyptus schoolhouse, 4 miles south of the city, has completed plans for another extension, work on which will begin at once.

LINDSAY, CAL.—The State Railroad Commission has granted the Tulare County Pwr. Co., of Lindsay, permission to issue $300,000 in bonds, the proceeds to be used to pay outstanding indebtedness and extend its transmission lines.

LIVINGSTON, CAL.—The San Joaquin Lt. & Pwr. Co., of Fresno, will soon begin work on the erection of a transmission line from Livingston to the Edgar Hogan ranch on Merced River.

LOS ANGELES, CAL.—Llewellyn Brothers, owners of the Llewellyn Iron Works, which have recently started the construction of a large factory, to cost $750,000, at Torrance, near Los Angeles, will build a large power plant in connection with the proposed factory.

LOS GATOS, CAL.—The Los Gatos Tel. Co. has applied to the State Railroad Commission for permission to increase its capital stock by $25,000, the proceeds to be used for the purpose of making additions to its plant and equipment.

MOUNTAIN VIEW, CAL.—The Board of Trustees has decided to call an election to submit the proposition to issue bonds for the installation of a municipal electric-light plant in connection with the water-works system to the voters.

OROVILLE, CAL.—The Oro El. Corpn. has announced that work will start on construction of its large dam and hydroelectric power plant in the Humbug Valley about April 15.

OROVILLE, CAL.—The Great Western Pwr. Co., of San Francisco, it is reported, has announced that upon completion this year of the Big Meadows dam work will begin immediately on the construction of four additional power plants at a cost of $8,000,000. The plans provide for the total development of 675,000 hp, to be completed by 1915, and include the enlargement of the present plant at Las Plumas, increasing the output to 82,000 hp (this work is to be completed in 1913); construction of a new power house at Bartles bar on the north fork of the Feather River; erection of a new power house at Grasner's place on the north fork near Mosquito Creek (this will include a tunnel 6 miles long), and the construction of a plant at the junction of Butte Creek and the north fork.

SAN FRANCISCO, CAL.—The Mount Konocti Lt. & Pwr. Co., of Lake County, has applied to the State Railroad Commission to issue $20,000 in capital stock and notes to the amount of $5,000.

SAN FRANCISCO, CAL.—The Board of Supervisors has passed an ordinance ordering the construction of an extension of the Geary Street municipal railway along Van Ness Avenue, from Market Street to the bay.

SAN FRANCISCO, CAL.—The Panama-Pacific International Exposition Co. has entered into a contract with the Pacific Gas & El. Co. under the terms of which in the next three and one-half years the latter will supply all energy required for lamps and motors during the term of the World's Fair in San Francisco in 1915 and during the period of construction and dismantling. It is estimated that about 20,000 hp will be required. Contracts have also been signed whereby the Pacific Company will furnish all steam and gas required by the Exposition.

VENICE, CAL.—The City Trustees have adopted a resolution authorizing City Attorney Hanna to draw up an ordinance providing for the establishment of an electric-light plant.

YREKA, CAL.—The California-Oregon Pwr. Co., of Medford, Ore., is extending its transmission lines in many directions to connect with large irrigation pumping units.

FARMINGTON, CONN.—The Union El. Lt. & Pwr. Co., of Farmington, has petitioned the State Legislature for an amendment of its charter allowing it to increase its capital stock from $125,000 to $500,000.

LITCHFIELD, CONN.—The Litchfield El. Lt. & Pwr. Co. expects to install within the next six months one 300-kw, three-phase, 60-cycle, 2300-volt generator directly connected to a 500-hp engine. Within the next five months the company expects to purchase a 500-hp engine and within the next four months three 25-kw, 2300-1100-volt, 60-cycle, single-phase transformers and 2 tons of weather-proof wire. A. J. Fromholz is manager.

WASHINGTON, D. C.—Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 12 for furnishing eleven 15-ton locomotive cranes with grab-bucket equipments, delivered and erected at the naval station, Pearl Harbor, Hawaii, and navy yard, Puget Sound, Wash. Specifications may be obtained on application to the Bureau of Yards and Docks. The cost of the work is estimated at $99,000. H. R. Stanford is chief of bureau.

ARCADIA, FLA.—The Arcadia El. Lt., Ice & Tel. Co. has sold its electric light and ice plant to the Utilities Securities Corpn., which will operate the plant under the name of the Arcadia Ice & El. Co. The telephone exchange is still held by the original owners and will be known as the Arcadia Tel. Co.

CHIPLEY, FLA.—Contracts will be awarded by the Chipley Lt. & Pwr. Co. in about 30 days for the construction of an electric-light plant. The equipment will include two boilers, a 115-hp steam engine, 5 miles of wire and cypress poles. Meters will be required for all buildings. N. A. Myers, Jr., is president.

JACKSONVILLE, FLA.—The Board of Bond Trustees has awarded the contract for the underground cable for lighting the business section of the city to the Florida Electrical Co., of Jacksonville, for about $115,000. H. R. Worthington is manager of the Florida Electrical Co.

MILTON, FLA.—The Town Council is considering an issue of $40,000 in bonds for the installation of a municipal electric-light plant and water-works system.

HOMERVILLE, GA.—L. H. Locklier, of Homerville, contemplates the installation of electric-light and ice plants here, and would like to communicate with manufacturers in regard to electrical equipment and ice machinery.

ROCHELLE, GA.—The J. B. McCrary Co., of Atlanta, Ga., has been engaged to make surveys and prepare plans for the installation of a municipal electric-light plant and water-works system. The proposition to issue bonds for construction of same will be submitted to a vote as soon as estimates are made. W. C. Carter is city clerk.

SAVANNAH, GA.—The Fairhope Land Co. is making arrangements for the development of an industrial center, to be known as Fairhope, on the Sapelo River, in McIntosh County, 50 miles from Savannah. The company proposes to install electric-light and ice plants, construct telephone system, etc. A. B. Offenbacher, Savannah Bank & Trust Co. Building, Savannah, is general manager.

ASSUMPTION, ILL.—The Assumption Mutual Tel. Co. has increased its capital stock from $5,000 to $25,000.

BETHALTO, ILL.—Harry McPhearson, of Bunker Hill, is contemplating the erection of a distributing system to furnish electricity for lamps and motors in Bethalto. The Madison County Lt. & Pwr. Co., of Granite City, is to build a transmission line to the limits of the village.

DE KALB, ILL.—The city of De Kalb is contemplating the installation of an ornamental street-lighting system on six blocks. About 64 reinforced granite concrete standards, carrying 6.6 amp lamps, will be erected. Armored cable placed in underground conduits will be used. J. H. Jarboe is chairman of the lighting committee and A. R. Russell is city engineer.

ELGIN, ILL.—The City Council has appointed a committee, consisting of Mayor Fehrman and Commissioners Hunter and Russell, to engage an electrical engineer to prepare estimates of the cost of a municipal electric light plant. The city now owns a plant which is leased for a number of years.

FINDLAY, ILL.—The Village Board has sold the municipal electric-light plant to the Central Illinois Pub. Ser. Co., of Mattoon, Ill., for $6,000. The company has already been granted a franchise in the village.

GALESBURG, ILL.—The Galesburg Utilities Co. contemplates the erection of a transmission line from Dallas City to Galesburg, at a cost of $85,000. Energy will be secured from the plant of the Mississippi

River Pwr. Co. at Keokuk, arrangements having already been made for building a transmission line from the Keokuk dam to Dallas City.

HILLSBORO, ILL.—The Hillsboro El. Lt. & Pwr. Co. will build a transmission line which will connect Palmer and Morrisonville with its line at Harvel. J. J. Frey is president and general manager.

LEWISTOWN, ILL.—The Canton Gas & El. Co., of Canton, contemplates extending its transmission line from Canton to Lewistown to supply electricity in the latter place.

MACOMB, ILL.—The lighting committee appointed by Mayor Keefer to secure estimates of the cost of installing a municipal electric-light system has submitted its report to the Council. The report provides for an initial installation of 50 arc lamps and 25 incandescent lamps for street lighting. The power plant equipment is to consist of one 100-lamp, 4-amp Brush arc generator, one 75-hp Corliss engine and switchboard, 50 4-amp arc lamps, 25 series incandescent lamps to be erected on wall brackets, 150 miles of pole line construction with necessary arc lamp suspensions, at a total cost of $13,478. D. H. Simmonds is a member of the committee.

MINONK, ILL.—The Illinois Central R. R. Co. is contemplating installing electrical power at its coal chutes, roundhouse and other buildings in Minonk.

MOLINE, ILL.—The People's Pwr. Co., of Moline, has awarded the contract for rebuilding its power plant in Moline to Henry W. Horst, of Rock Island, for $25,000.

MONTICELLO, ILL.—An option has been taken on the plant of the Monticello El. Lt. & Pwr. Co. by the Illinois Trac. System, of Champaign, which proposes to supply electricity here, to be transmitted from Champaign. C. A. Tatman is secretary and manager of the Monticello company.

NAPIERVILLE, ILL.—The Du Page County El. Lt. & Pwr. Co., a subsidiary of the Aurora, Elgin & Chicago R. R. Co., has been granted a 10-year franchise to supply electricity here. A transmission line will be erected from the substation at Warrenville to Napierville, a distance of 4 miles.

NOBLE, ILL.—Arrangements are being made for the installation of an electric-lighting system here. The service will be supplied by the Central Illinois Pub. Ser. Co., of Mattoon, from its plant at Olney.

SHELBYVILLE, ILL.—Application has been made to the City Council by the Central Illinois Pub. Ser. Co., of Mattoon, Ill., for a 50-year franchise to operate a high-tension transmission line through Shelbyville.

SILVIS, ILL.—The Village Board has decided to replace the present arc lamp street-lighting system with tungsten lamps. The United Lt. & Power Co., of East Moline, furnishes the street-lighting service.

SOUTH CHICAGO, ILL.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 2, for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the United States post office at South Chicago. Drawings and specifications may be obtained from the above office or from the custodian of site at South Chicago. O. Wenderoth is supervising architect.

GOSHEN, IND.—The City Council has approved the preliminary plans of Burns & McDonnell, of Kansas City, consulting engineers, for rehabilitating the municipal electric-light plant. The plans call for two generators, one of 250 kw and the other of 75 kw, the first for night load and the other for day load; one engine, with jet condenser; one new switchboard complete; ornamental lamps on Main Street, from Middlebury to Jefferson Street, and on Lincoln Avenue, from Ninth to Second Street; alternating-current arc and tungsten lamps in the residence district; piping over boilers, and completely remodeling the outside distributing system.

WINDFALL, IND.—The Board of Trustees has entered into a contract with the Indiana Union Trac. Co. to furnish electricity for lighting the town, also for commercial and domestic purposes.

AFTON, IA.—The City Council has voted to enter into a contract with the Creston Mutual El. Lt., Ht. & Pwr. Co. to furnish the city with electricity. The company will erect a transmission line to Afton. A 24-hour service will be established when the new system is installed.

ALBION, IA.—A special election will be held March 27 to vote on the proposition to grant a franchise to the Iowa River Lt. & Pwr. Co., of Eldora, to furnish electricity for lamps and motors here. J. H. Hardenburgh is vice-president of the company.

BAYARD, IA.—The proposition to install an electric-light plant in Bayard will be submitted to the voters about May 1. George C. O'Donaghey, of the engineering and mining department of the Alamo Engine & Supply Co., of Omaha, Neb., will make surveys and prepare plans for the proposed plant. F. E. Munger is clerk.

BURLINGTON, IA.—Walsh Brothers have closed a contract with the Mississippi River Pwr. Co., of Keokuk, whereby the latter will furnish energy for the Burlington Street Railway system and the light, heat and power plants.

CLINTON, IA.—The civic improvement committee of the Clinton Commercial Club announces that ornamental street lamps will be erected on four blocks of Second Street. N. D. Patterson is interested.

FONTANELLE, IA.—A petition has been presented to the Council asking for action relative to the installation of an electric-light plant and water-works system. An election will probably be called about April 1, and if the project is approved by the voters it is proposed to erect a 7-mile transmission line to a plant in an adjoining town or to install an oil-engine plant, probably of 80 hp. About 120 meters will probably be needed. As yet no engineer has been engaged.

GREENFIELD, IA.—Contracts will be awarded by the City Council on April 11 for the installation of a new municipal electric-light plant here. J. B. Hill, of Iowa City, is consulting engineer.

LE MARS, IA.—A special election has been called for March 20 to vote on the proposition as to whether the city shall purchase the electric-light and water-works systems now owned and operated by the Le Mars Wtr. & Lt. Co.

LEON, IA.—The Leon El. Co. has increased its capital stock from $30,000 to $100,000, the proceeds to be used for additions and improvements to its system. The company is now erecting a transmission line to Garden Grove, which later will be extended to Humeston. The residents of Weldon have asked the company to furnish electrical service in that town, and its transmission lines will probably be extended to that place and possibly to other towns in the county.

LISCOMB, IA.—At an election held recently the proposition to grant the Iowa River Lt. & Pwr. Co., of Eldora, a 25-year franchise to furnish electricity in Liscomb was carried.

LOW MOOR, IA.—A proposition has been submitted to the City Council for the installation of an electric-light plant in Low Moor. As yet no definite action has been taken. John T. Chandler is city clerk.

MANCHESTER, IA.—The Hoag El. Lt. & Pwr. Co. contemplates extensive improvements to its plant and service. Additional equipment will be installed in order to equip the plant to furnish a 24-hour service. E. W. Hoag is owner and manager.

PERRY, IA.—The Chicago, Milwaukee & St. Paul Ry. Co. is planning to install an electric plant at its terminal in Perry, to furnish electricity for lighting the coaling and water plants, car shops, yards, etc. Electric lamps will also replace the oil lamps for lighting the switches in Perry.

PRESTON, IA.—Plans and specifications are being prepared for a municipal electric-light plant in Preston. J. B. Hill, of Iowa City, has been retained as consulting engineer.

QUASQUETON, IA.—Petitions are being circulated asking the City Council to call an election to submit to the voters the proposition to issue bonds for the installation of a combined electric-light plant and water-works system.

ROCKWELL, IA.—The voters have approved the proposition to grant C. C. Carhart, of Sheffield, a franchise to operate an electric-light system here. A transmission line will be erected from the power plant in Sheffield to Rockwell, a distance of 6 miles.

SPENCER, IA.—The City Council has decided to extend the municipal electric-light service to South Spencer. Plans are being prepared for improvements and enlarging the municipal plant. K. C. Gaynor, of Sioux City, is consulting engineer.

STATE CENTER, IA.—The proposition to grant a franchise to the Iowa Ry. & Lt. Co. to distribute electricity in State Center may be submitted to the voters at an election to be called soon.

BUFFALO, KAN.—The Buffalo El. Lt. & Pwr. Co. has recently installed an electric light and power plant at the Buffalo brick works to furnish electricity for lamps and motors. The equipment consists of two 90-kw. 60-cycle alternating-current generators, with switchboard equipment, transformers, etc; about 150 poles, 8 miles of wire and 20 Westinghouse meters. At present the company does not furnish street-lighting service. H. J. Huiskamp, Jr., is president.

CONCORDIA, KAN.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 31, for construction complete, including plumbing, heating apparatus, gas piping, electric conduits and wiring and interior lighting fixtures and approaches, of the United States post office at Concordia, Kan. Drawings and specifications may be obtained at the above office or from the custodian of site at Concordia. O. Wenderoth is supervising architect.

TOPEKA, KAN.—The Shawnee Milling Co. has applied to the city commissioners asking that it might be allowed to utilize the power developed at the city crematory to generate electricity. The company also asks for a franchise to distribute electricity in the main business district in Topeka. It is proposed to secure a lease on the garage plant and to erect buildings nearby to install generating equipment, etc.

CORYDON, KY.—The contract for equipment of the new municipal electric light and power plant has been awarded to the L. H. Swanson Co., of Evansville, Ind.

LAWRENCEBURG, KY.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 8 for construction, including plumbing, heating apparatus, gas piping, electric conduit and wiring and lighting fixtures, of the United States post office at Lawrenceburg, Ky. O. Wenderoth is supervising architect.

MIDDLESBORO, KY.—The property of the Middlesboro El. Co. has been purchased by the Kentucky Utilities Co. for $100,000.

PADUCAH, KY.—Extensive improvements are contemplated by the East Tennessee Tel. Co. to its local system, involving an expenditure of $300,000.

PINEVILLE, KY.—Plans for the construction of a large power plant in Bell County, to cost $1,500,000, are under consideration. It is proposed to supply electricity for lamps and motors at the many coal mines in this section of the State; also to the border counties of Virginia and Tennessee. Col. Charles W. Metcalfe, D. Boone Logan, president of the Bell County National Bank; T. F. Gibson and H. J. Gibson, all of Pineville, are interested in the project.

WILLIAMSTOWN, KY.—A franchise has been awarded to J. M. Riley to install an electric-light plant in Williamstown. Equipment for the proposed plant will be purchased in the near future.

WILLIAMSTOWN, KY.—The Queen & Crescent Railway is planning to equip its electric block and switch signals with electric lamps from Williamstown to Ludlow, a distance of 35 miles. It also proposes to light all the railway stations with electricity. The company also plans to equip the division from Ludlow to Danville with a telephone system for train dispatching to take the place of the present telegraph system.

ELLERSLIE, MD.—The Cook's Mill El. & Pwr. Co., owned by Deal Brothers, of Cumberland, has been granted permission by the Allegany County road directors to erect transmission lines over the county roads from the Pennsylvania State line to Corrigansville for the purpose of supplying electricity here.

ELLERSLIE, MD.—The Allegany County Road Directors have granted the Andrew Ramsay Corpn. a franchise to erect transmission lines along the highways of the county from a point near Ellerslie to Corrigansville. The company proposes to erect a large electric light and power plant near Ellerslie to supply electricity for its large brick plant at Mount Savage and also for lamps and motors in Ellerslie. The company has secured permission from the Legislature to consolidate its plants at Mount Savage and Ellerslie.

BEVERLY, MASS.—The Beverly Gas & El. Co. contemplates increasing its capital stock to provide funds for additions to its plant and system and for extending its underground conduit circuit about 5 miles. The present docks on River Street are to be enlarged and the plant improved.

BOSTON, MASS.—The Edison El. Illg. Co. has acquired a site on Stuart Street, on which it will erect a six-story building to be used as a substation to serve a territory within a radius of about a mile. The cost of the station complete is estimated at between $300,000 and $400,000.

CHATHAM, MASS.—The Buzzards Bay El. Lt. Co., of Falmouth, contemplates extending its transmission line to Chatham to furnish electrical service.

FALL RIVER, MASS.—The aldermanic committee on street lamps has voted to accept the proposition of the Fall River El. Lt. Co. for the installation of an ornamental lighting system consisting of 84 lamps in the central business section of the city. The committee has voted an extension of the special lighting system on Bank Street between North Main and Rock Streets, and further south on Main Street from Columbia to Morgan Street.

HOLYOKE, MASS.—Proposals will be received by the Gas and Electric Department until March 24, for furnishing various supplies, including coal, coke, gas meters, incandescent lamps, meters and transformers and all other supplies used in generating gas and electricity. John J. White is Mayor and acting manager of the Gas and Electric Department.

SOUTH HADLEY FALLS, MASS.—The Amherst Pwr. Co. has purchased the capital stock of the South Hadley Falls El. Lt. Co. The sale does not include the building occupied by the electric plant here. The local station will be closed and energy will be supplied by the Amherst Pwr. Co. from its substation at Mount Tom. Extensive improvements will be made by the new owners, including the erection of a substation in South Hadley Falls and extension of the system to include Granby.

SPENCER, MASS.—The Spencer Wire Co. has decided to equip its plant in Wire Village with electrically driven machinery and to light the five mills with electricity. It is understood that energy will be furnished by the Spencer Gas Co. Improvements will be made to the plant of the Spencer Gas Co. to enable it to supply a 24-hour service.

BATTLE CREEK, MICH.—Plans are being prepared for extending the ornamental street-lighting system on West Main Street as far as Washington Street, then up Washington to the Sanitarium Annex.

CORUNNA, MICH.—The Village Board has entered into a contract with the Consumers' Pwr. Co. to install 50 60-watt street lamps.

DETROIT, MICH.—The Solvay Process Co. has taken out a permit to erect a 10-story steel factory building to cost about $200,000, work on which will start in the spring. Considerable electric equipment will be used and an elevator will be installed.

FLINT, MICH.—It is reported that A. M. Kingman, of Cleveland, Ohio, assistant commercial engineer of the National Electric Lamp Association, has been authorized to prepare two sets of plans for street lighting to be presented to the lighting committee. One plan will provide for a cluster-lamp system and the other for a single arc lamp erected on a standard.

HOLLY, MICH.—The Edison El. Illg. Co., of Detroit, has applied for a franchise here. The company has asked for franchises in all the townships between Detroit and Holly. An election has been called in all townships to vote on the proposition.

LANSING, MICH.—The Board of Electric Light Commissioners has authorized the purchase of a 2000-kw steam turbine from the Allis-Chalmers Co., to cost $31,700; also a 3,000,000-gal. motor-driven centrifugal pump from the Alberger Pump & Condenser Co., of Milwaukee, to be installed in the municipal power plant.

MARQUETTE, MICH.—Three rotary electric pumps are to be installed in the city water-works. Transmission lines will connect the water-works with the high-tension line from the generating station at Dead River. A switchboard and three transformers to step the current down from 6600 volts to a voltage low enough for the motors will also be installed.

MUSKEGON, MICH.—The city of Muskegon is considering the installation of an ornamental street-lighting system on Western Avenue.

PETOSKEY, MICH.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 1 for the construction, including plumbing, gas piping, steam-heating apparatus, electric conduits and wiring, interior-lighting fixtures and approaches, of the United States post office at Petoskey, Mich. Drawings and specifications may be obtained at the above office or from the custodian of site at Petoskey. O. Wenderoth is supervising architect.

VANDALIA, MICH.—The Council has contracted with the Constantine Hydraulic Co., of Three Rivers, to furnish electricity for lighting in Vandalia. Work will begin on the erection of the transmission line and wiring the village as soon as the frost is out of the ground.

AURORA, MINN.—Work will begin in the spring on the construction of the Northern Minnesota Pwr. Co.'s power plant on the St. Louis River.

LAKE CITY, MINN.—The officials of Lake City are contemplating building a reservoir of 1,000,000 gal. capacity on a bluff back of the city with a pipe line leading to the present light and water plant. The preliminary report of this extension is to be made by the Oscar Claussen Engineering Co., of St. Paul.

PAYNESVILLE, MINN.—Plans are being considered for extensions and improvements to the municipal electric-light plant and water-works system, including rebuilding and extending transmission lines and possibly changing the system from direct to alternating current; also erecting a new steel tank with steel or wood tower. John H. Harigen is recorder.

YOUNG AMERICA, MINN.—The Village Council has granted the Lethert El. Co., of St. Paul, a franchise to supply electricity for lamps and motors here.

NATCHEZ, MISS.—Bids will be received by B. G. Geisenberger, president board of trustees, for material and wiring for electric lamps for Carpenter Memorial School No. 2, Natchez, until March 25. Plans and specifications may be obtained from J. H. Owings, of Natchez, and from R. H. Hunt, of Chattanooga.

JOPLIN, MO.—The installation of a new street-lighting system in the residence section in the north part of the city is being promoted by the North Heights Improvement Society.

HARLOWTON, MONT.—The Meagher County Tel. Co. has voted to expend $2,000 for improvements and extensions to its plant and toll line; also for the installation of a new switchboard.

DONIPHAN, NEB.—The City Council has decided to call an election to vote on the proposition to grant an electric-light franchise. The franchise will be voted to P. J. Burford and E. K. Ponder, to be held in trust until some responsible company meets the requirements of the Council to establish an electric plant.

LINCOLN, NEB.—The State Railway Commission has granted the Omaha, Lincoln & Beatrice Ry. Co. permission to issue $2,250,000 in bonds and $850,000 in capital stock, the proceeds to be used for the construction of an interurban railway between Omaha and Lincoln. Work will begin as soon as the weather will permit.

LINCOLN, NEB.—W. R. Leffler has applied to the State Railway Commission for permission to issue $250,000 capital stock for the purpose of developing a hydroelectric power plant on the Platte River, near Springfield. It is understood that Mr. Leffler has a patent device whereby he expects to generate electricity at a greatly reduced cost.

PHILLIPSBURG, N. J.—The City Council has granted the Phillipsburg Lt., Ht. & Pwr. Co. a franchise to construct and operate an electric light and power plant here.

DEMING, N. M.—The Mimbres Valley Alfalfa Farms Co. has entered into a contract with the Federal Lt. & Trac Co. for construction of an electric transmission line from Deming to the large tract of land which it is developing near here, to supply electricity to operate the irrigation pumping plants. The Federal Lt. & Trac. Co., it is stated, will install a large power plant, to cost about $400,000, in Deming. It is understood that the present plant will be dismantled. The Mimbres Valley Alfalfa Farms Co. will put down a number of wells and install pumping plants. A. A. Corey, H. B. Burnett, of Pittsburgh, Pa.; C. E. Miesse, of Chicago, Ill.; H. V. Olney, of Van Wert, Ohio; W. D. Murray, of Silver City, and H. H. Kelly, of Deming, are interested in the Mimbres company.

TUCUMCARI, N. M.—The city of Tucumcari is contemplating the installation of an ornamental street-lighting system, which will require 28 ornamental standards, carrying three-lamp clusters, and four standards carrying five-lamp clusters, together with necessary underground cables, etc. S. B. Richey, resident manager of the Tucumcari Lt. & Pwr. Co., will have charge of the work.

BROOKLYN, N. Y.—Proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 25 for wire to be delivered at the Brooklyn navy yard under schedule

5246 as follows: miscellaneous quantities of galvanized soft-steel armored cable, interior communication cable, plain telephone cable, galvanized, soft-steel, armored and leaded telephone cable, single-conductor wire and twin-conductor wire.

HORNELL, N. Y.—The control of the Hornell El. Co. has passed into the hands of a syndicate of Philadelphia capitalists, composed of H. L. Elkins, president of the Colonial Trust Co., of Philadelphia; William M. Measey and E. F. McCabe, electrical engineers, both of Philadelphia. It is understood that the new owners contemplate improvements to the plant and system involving an expenditure of about $100,000. L. T. Mason will be retained as superintendent.

LOCKPORT, N. Y.—The International Ry. Co. is contemplating the double-tracking of 16 miles of its line from a half mile south of the old Erie Depot in North Tonawanda to this city. The proposed work will cost about $500,000 and will start early this spring.

NEW YORK, N. Y.—The Public Service Commission has given its approval to the application of the Long Acre El. Lt. & Pwr. Co. for the construction of an electric plant and for permission to issue $2,000,000 in capital stock and $4,000,000 in bonds.

ONEONTA, N. Y.—The Public Service Commission, Second District, has authorized the Otsego & Herkimer R. R. Co. to execute a mortgage for $2,500,000 and to issue bonds to the amount of $1,200,000, part of the proceeds to be used to purchase the property formerly operated under the name of the Oneonta, Coopersfield & Richfield Springs R. R. Co., which was sold at foreclosure sale, and also to acquire the property of the Hartwick Pwr. Co., which furnishes electricity to operate the railways. The Colliers Lt., Ht. & Pwr. Co. has been authorized to issue $25,000 capital stock and $135,000 in bonds to acquire the property of the Clinton Mills Pwr. Co., of Cooperstown, and the Richfield Springs El. Lt. & Pwr. Co., which operates in Richfield Springs. The water-power plant and steam plant formerly owned by the Clinton Mills Pwr. Co. will be used to supplement and as a reserve for the power to be taken from the railroad company.

SARANAC LAKE, N. Y.—The Paul Smith El. Lt. & Pwr. & R. R. Co. has decided to extend its transmission lines through Blackbrook to Ausable Forks, a distance of 14 miles, to supply electricity for lamps and motors in several additional villages in Essex County. It also proposes to extend its transmission lines to Rogers and Arnold to supply energy to the Witherbee & Sherman Co. and the Steel company, which own large iron ore deposits in and around Rogers. The power company has already entered into a contract with the J. J. Rogers Pulp & Paper Co., at Ausable Forks, to furnish electricity for lighting and operating the plants of the paper company there.

BURLINGTON, N. C.—Contracts will be awarded by the Piedmont Trac. Co. about March 25 for extensions to its local plant. The equipment will include three 500-hp boilers with 175 lb. pressure, steam engine or turbine and generators. Details of equipment have not yet been decided upon. J. H. Bridgers, of Henderson, is engineer in charge of the work. G. W. Hatch, of Burlington, is superintendent of the company.

CLAYTON, N. C.—Contracts have been awarded to Tucker & Laxton, of Charlotte, for the erection of pole-line work for the combined water and lighting system at Clayton, for $8,000. Energy for the system will be purchased from the Carolina Pwr. & Lt. Co., of Raleigh, N. C., and a 150-kw outdoor transformer and switching station will be installed. The voltage will be reduced from 60,000 to 2200 for local distribution and two 50-hp electrically driven pumps erected in the pumping station. The lighting equipment will cost about $15,000. The Westinghouse El. & Mfg. Co., of Pittsburgh, is the lowest bidder. Gilbert C. White, of Charlotte, is consulting engineer.

GRAHAM, N. C.—A company headed by State Senator J. H. Bridgers, of Henderson, has taken over the Piedmont Ry. & El. Co., operating a small railway between Burlington and Graham; the Graham Wtr. & El. Co., the Graham Ice Co. and the municipal electric-light plant at Burlington. A new power station will be erected between Burlington and Graham, on the route of the railway, and the old plants will be dismantled. The present 17-ton ice plant operating in conjunction with the central station at Graham will be transferred to the new station and a duplicate plant of the same size installed. The street-lighting system, which operates now on a moonlight schedule, will be reconstructed and an all-night schedule adopted. A day service will also be established in Burlington, Graham, Haw River, Elon College, Swepsonville and Mebane, and the system will be extended. The water system at Graham will be connected with the water system in Burlington. Work will soon begin on the new station, and it is understood that two 750-kw units will be installed. The new company will be capitalized at $700,000 and the officers are: J. H. Bridgers, of Henderson, president and general manager, and J. W. Murray, of Henderson, vice-president.

MEBANE, N. C.—The Piedmont Trac. Co., of Charlotte, has been granted a 50-year franchise to supply electricity for lamps and motors in Mebane.

SCOTLAND NECK, N. C.—The Crescent Hosiery Co., of Scotland Neck, is contemplating purchasing power from the municipal electric light and power plant. If the deal goes through, a 24-hour service will be established. The Crescent Hosiery Co. expects to purchase several motors, but as yet details have not been decided upon. L. R. Mills, Jr., is manager of the municipal electric plant.

SPENCER, N. C.—The State Legislature has granted the city of Spencer authority to vote on the proposition to issue $50,000 in bonds for an electric-light plant and water-works system.

BINFORD, N. D.—Plans are being considered for the installation of an electric-light plant in Binford. It is proposed to establish a 24-hour service at the start.

MAYVILLE, N. D.—The City Council has decided to enlarge the municipal electric-light plant. Work will begin as soon as the weather permits.

MOTT, N. D.—C. J. Lee, of Valley City, contemplates the construction of an electric-light plant in Mott.

CLEVELAND, OHIO.—The Cleveland El. Illg. Co. has awarded a contract to F. Hauselman for the erection of a substation at 5371 St. Clair Avenue. The building is to be 50 ft. by 56 ft. and two and one-half stories high.

MOUNT VERNON, OHIO.—The Knox County Commissioners are contemplating the installation of an improved lighting system for the viaduct and also about the exterior of the court house and jail. Cluster lamps are being considered for the viaduct.

NEW LEXINGTON, OHIO.—The Public Service Commission has granted T. J. Smith, owner of the local electric-light plant, permission to sell the plant to the American Gas & El. Co., of New York, N. Y.

PURCELL, OKLA.—The City Commissioners have awarded the contract for rehabilitating the Purcell electric-light plant and water-works system to J. W. Kennedy. The cost of the work is estimated at $23,974. The plant has not been in use for several months.

ASHLAND, ORE.—The Minney Street Ry. Co. has been granted a franchise to build a street-railway system in Ashland. A similar franchise has been secured in Medford. The company proposes to connect the two cities.

CORVALLIS, ORE.—The property owners on Madison Street have offered to install ornamental standards complete for cluster lamps, provided that the city will maintain the lamps.

PENDLETON, ORE.—We are informed that the city of Pendleton does not contemplate the installation of a municipal electric-light plant, the project having been abandoned for the present. John Fitzgerald is city recorder.

ANALOMINK, PA.—G. Barrett Decker, owner of the Analomink grist mills, has awarded contract for the installation of an electric-light plant. The plant will be installed in the grist mill and will have sufficient output to maintain 800 lamps of 16 cp.

HARRISBURG, PA.—Applications will be filed with the State Department on March 21 for new charters for 25 electric companies to operate in Beaver County. The incorporators are: Herbert W. Kalberer, Arthur B. Dampman and William E. Miller. Wilson & Evans, of Pittsburgh, are solicitors. The towns and townships embraced in the applications are as follows: Ambridge, Baden, Conway, Freedom, Daugherty Township, Harmony Township, Economy Township, Rochester Township, Hopewell Township, Moon Township, Rochester, East Rochester, Monaca, Aliquippa, South Heights, Woodlawn, Fallston, Bridgewater, Beaver, Beaver Falls, New Brighton, Pulaski Township, Patterson Township and Brighton Township.

LACEYVILLE, PA.—We are informed that A. L. Vandervort does not contemplate the installation of an electric-light plant as reported in the issue of March 1.

PITTSBURGH, PA.—The Pittsburgh & Butler St. Ry. Co. contemplates changing its present electric-power service to the direct-current system. Coincident with this change other improvements will be made, including increased safety protection, new substations, etc.

PITTSBURGH, PA.—An additional foundry building is to be erected by the Westinghouse Air Brake Co. at its Wilmerding plant, plans for which have been completed, and estimates are now being taken. The equipment will include two 5-ton and two 10-ton electric traveling cranes, molding machines and appliances.

READING, PA.—Mayor Stratton has signed the resolution authorizing the execution of an agreement with the Metropolitan El. Co., of Reading, for furnishing electricity to operate the sewage disposal pumping station. The station is now equipped with steam pumps.

READING, PA.—The Metropolitan El. Co., of Reading, will make improvements to its transmission system between Reading and Annville, at a cost of about $1,500,000. The company will erect six high-tension transmission lines between here and Lebanon and other lines between Lebanon and Hershey.

SHARON, PA.—The referendum vote at the election held Feb. 25 resulted in a decision to accept the contract offered by the Shenango Valley El. Lt. Co. in lieu of building a municipal plant to cost $85,000.

SHARPSBURG, PA.—Sealed bids will be received at the office of the borough clerk, Sharpsburg, until March 27 for power plant equipment as follows: Two 375-kva, three-phase, 60-cycle, 2300-volt generators, complete with exciters, etc. Alternate proposals on prime movers as follows: Two 450-hp directly connected type simple steam engines; two 450-hp directly connected cross compound steam engines; two 375-kva steam-turbine-driven alternating-current generating units; complete condensing equipment; three 50-lamp 4-amp metallic-flame arc-lamp equipments complete; one four-panel switchboard complete. Specifications can be obtained from Sidney B. Martin, consulting engineer, 616 Penn Building, Pittsburgh, Pa.

SHARPSVILLE, PA.—The Sharpsville El. Co. has asked the Council for a renewal of its street-lighting contract, which expires May 1. The

company has erected six new 100-watt Mazda lamps on Walnut and Main Streets for experimental purposes. The company contemplates the installation of new lamps if granted a renewal of contract.

SOMERSET, PA.—The railroad yards of the Baltimore & Ohio R. R. Co. located south of Somerset are being equipped with electric-arc lamps energy to be supplied by the Somerset El. Lt., Ht. & Pwr. Co. It is understood that the company will soon equip the numerous switches in the yard to be operated exclusively by electricity. The local electric company will also supply energy to operate the switches.

WARREN, PA.—Arrangements are being made by the Warren Lt. & Pwr. Co. for the installation of an ornamental street-lighting system on Liberty Street. Ornamental standards carrying five-lamp clusters will be erected on the west side of the street.

EAST PROVIDENCE, R. I.—Plans have been submitted by the Narragansett El. Ltg. Co., of Providence, for the installation of a new street-lighting system. It is proposed to discard the arc lamps and the 32-cp incandescent lamps now in use and substitute 350-cp and 60-cp incandescent lamps.

SELBY, S. D.—All bids opened on March 4 for installing lighting fixtures and electric-light plant in the county court house and jail were rejected. New bids will probably be called for. H. A. Taylor is county auditor.

BROWNWOOD, TEX.—The Texas Pwr. & Lt. Co. has begun work on improvements to its local plant, which will involve an expenditure of about $70,000. W. C. Riker is engineer in charge.

FLATONIA, TEX.—C. A. Pierson, of Axtell, Neb., has purchased the electric light and power plant, water-works system and ice factory of the Flatonia Ice, Wtr. & El. Co. Mr. Pierson contemplates extensions and additions to the property.

SINTON, TEX.—The Coleman-Fulton Pasture Co. has purchased the local electric-light and ice plant and will make improvements to the system immediately, including the installation of new machinery.

SALT LAKE CITY, UTAH.—The Utah Pwr. & Lt. Co. has taken over the Eccles electrical interests in Cache, which includes the property of the Blacksmith Fork Lt. & Pwr. Co., work on which has just been completed, and the High Creek El. Lt. & Pwr. Co., 5 miles east of Franklin. As soon as the Utah Pwr. & Lt. Co. takes over the property it will erect transmission lines and begin the operation of the new plant.

NORTON, VA.—Arrangements are being made for the erection of a large electric-light and power plant in Norton, for the purpose of supplying electricity for lamps and motors to nearby towns, mining operations and manufacturing plants in Wise County. Orders for equipment have already been placed and it is expected to have the plant ready to operate by June 1. The project, it is said, is being financed by the New York Mining & Mfg. Co. M. S. Kemmerer, 143 Liberty Street, New York, N. Y., is president.

CASHMERE, WASH.—The City Council has passed an ordinance providing for the installation of cluster lamps, to cost approximately $4,000. Bids for materials and installation are now being received.

COLVILLE, WASH.—A telephone company is being organized to extend the farmers' telephone system from Colville to the Pend Oreille Lakes along the state road, a distance of 27 miles.

KIRKLAND, WASH.—Preliminary surveys have been made and work will soon begin on the construction of an electric line between Kirkwood and Monroe. A company known as the Kirkland-Redmond Ry., Lt. & Pwr. Co. has been organized to build and operate the system. W. P. Perigo, of Redmond, is interested in the project.

OROVILLE, WASH.—Sealed bids will be received by L. L. Work, president of the Similkameen Pwr. Co., Oroville, until May 15, for the purchase of the hydroelectric plant and other property of the Similkameen Pwr. Co., located on the Similkameen River, in Okanogan County, about 4 miles from Oroville; said property consists of water appropriations, power plant, buildings, machinery, concrete work, waterways and tunnel, transmission lines, transformers, tools, fixtures, wire, supplies, franchises and contracts. Detailed information regarding the property and present and prospective employment of electric current given on application.

PORT TOWNSEND, WASH.—The City Council has authorized the installation of an electrically operated fire-alarm system, bids for which will soon be asked.

SPOKANE, WASH.—The Great Northern R.R. Co., it is reported, has contracted with the Edison El. Co. to equip its main line between Spokane and the coast, a distance of 500 miles, for electrical operation. The Edison El. Co. has filed a notice of appropriation of 25,000 in. per second of water from the Columbia River at Rock Island.

TACOMA, WASH.—Plans are being considered by Owen Woods, commissioner of public works, for the construction of a street-car line up Seventeenth Street from Pacific Avenue to connect with the proposed tide flats line. Estimates will be obtained on the cost of both an electric and a cable line.

TACOMA, WASH.—Plans are being considered to utilize the water, now going to waste, at the McMillan reservoir of the municipal Green River gravity water system to generate electricity and to be used as a small auxiliary to the municipal power plant on the Nisqually River at La Grande. It is estimated that 1600 hp could be developed.

VANCOUVER, WASH.—Work will begin at once on the construction of a power station, an office, waiting room and substation in Vancouver for the Portland Ry., Lt. & Pwr. Co., to cost about $30,000. The steam-power plant will be equipped with a battery of three boilers. Oil or sawdust will be used for fuel.

WHEELING, W. VA.—The County Commissioners have granted the Wheeling Electrical Co. a 50-year franchise to erect and maintain electric transmission lines from the corporate limits of Warwood to the county of Brooke, at the outskirts of Wellsburg. The company has also been granted a franchise by the Ohio County Commissioners to erect transmission lines through the Top Miss Road.

BRODHEAD, WIS.—At a special election held recently the proposition to issue $40,000 in bonds for a municipal electric-light plant was carried

MILWAUKEE, WIS.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 28 for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States appraisers' stores at Milwaukee, Wis. Drawings and specifications may be obtained at the above office or from the custodian of site, Milwaukee. O. Wenderoth is supervising architect.

DOUGLASS, WYO.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 12 for construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior-lighting fixtures and approaches, of the United States post office at Douglass, Wyo. Drawings and specifications may be obtained from the above office or from the custodian of site. O. Wenderoth is supervising architect.

MEDICINE HAT, ALTA., CAN.—The Alberta government has awarded the contract for equipment for an automatic telephone system in Medicine Hat to the Automatic El. Co., of Chicago, Ill. The contract provides for the installation of 2000 automatic telephones complete immediately. The ultimate capacity of the exchange is to be 5000 lines.

STRATHMORE, ALTA., CAN.—A company is being organized, to be known as the Strathmore Lt. & Pwr. Co., to install an electric-light plant here. Present plans provide for the installation of a plant to develop 100 hp. Either gas, gasoline or kerosene will be used for fuel. A. W. Bowman is interested in the project.

NEW WESTMINSTER, B. C., CAN.—Plans have been filed in the government offices for the construction of a hydroelectric power plant, to be operated by a company known as the Westminster Pwr. Co., Ltd. The names of the promoters are not given.

VANCOUVER, B. C., CAN.—The Western Canada Pwr. Co. contemplates the erection of a transmission line across the Burnaby municipality to the north arm of the Fraser River which would furnish electricity to a large portion of Burnaby, the manufacturing sites along the north arm of Fraser River and on Lulu Island. William McNeil, of Vancouver, is general superintendent.

CAYUGA, ONT., CAN.—The ratepayers have approved the by-law to contract with the Hydro-Electric Power Commission for power.

OTTAWA, ONT., CAN.—The city of Ottawa has applied to the Hydro-Electric Power Commission of Ontario for an additional 1000 hp of energy. The present contract calls for 4000 hp.

OTTAWA, ONT., CAN.—The City Council has decided to apply to the Ontario Railway and Municipal Board for authority to issue $50,000 in debentures to provide funds to enlarge the municipal electric light plant.

ST. CATHARINES, ONT., CAN.—The Niagara, St. Catharines & Thorold Co. will erect a new power station in St. Catharines, to be equipped with two 500-kw rotary converters and transformers, orders for which have been placed with the Canadian General El. Co. The company has also contracted for a 750-kw rotary converter and transformer in connection with its Niagara-on-the-Lake extension.

SARNIA, ONT., CAN.—Investigations are being made by R. H. Jeffrey, engineer for the Hydro-Electric Power Commission, with a view of extending the service of the Hydro-Electric Commission to Sarnia.

TORONTO, ONT., CAN.—The Toronto & Niagara Pwr. Co. has filed at Ottawa a map of route of a transmission line from Burlington to Toronto and from Humber River to Sunnyside Avenue.

WELLAND, ONT., CAN.—The municipality of Welland has purchased the complete distribution system of the Ontario Pwr. Co., of Niagara Falls, Ont., within the town limits, including substation and all auxiliary equipment. The contracts held by the Ontario Pwr. Co. have been taken over by the municipality.

MONTREAL, QUE., CAN.—The National Hydro-Electric Co., which proposes to develop water-power at Carillon Falls, has applied to the Montreal City Council for permission to distribute electricity here. The company is now installing a small plant of 1000 hp in four units.

MOOSE JAW, SASK., CAN.—Tenders will be received by the city commissioners until March 26 for one fuel economizer with 7000 sq. ft. heating surface and one induced-draft plant to handle 120,000 cu. ft. of gases per minute. Plans, etc., may be obtained upon application to J. D. Peters, electrical superintendent.

SWIFT CURRENT, SASK., CAN.—Sealed tenders will be received by the secretary and treasurer of Swift Current, Sask., until March 31 for furnishing one 200-kw and one 400-kw alternating-current generator directly connected to high-speed vertical or horizontal turbines, complete with all accessories. Copies of specifications may be obtained from George D. Mackie, town engineer.

New Industrial Companies

THE AMATEUR MECHANICS' SUPPLY COMPANY, of Chicago, Ill., has been incorporated by E. M. Christenson, Peter Walker and Charles W. Terrice. The company is capitalized at $2,500 and proposes to manufacture electrical machinery and novelties.

THE AUTOMATIC RETRIEVING TROLLEY CORPORATION, of Los Angeles, Cal., has been incorporated with a capital stock of $500,000 by S. E. MacFarland, C. Gonzales and B. I. MacFarland.

THE CARELS DIESEL MOTOR COMPANY OF AMERICA has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $10,000,000. The incorporators are: H. E. Latter, W. J. Maloney and N. P. Coffin, of Wilmington, Del.

THE CHICAGO ELECTRIC CASTINGS COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $11,000 to manufacture electric furnaces and equipment. The incorporators are: Wilton Bently, Edward C. Higgins and Matthew Flinn.

THE CO-OPERATIVE ELECTRIC COMPANY, of Atlanta, Ga., has been incorporated for the purpose of dealing in electrical supplies and fixtures. The incorporators are: H. F. Gheesling, F. B. Davis and W. T. Proctor.

THE EGYPTIAN ELECTRIC COMPANY, Chicago, Ill., has been incorporated by A. A. Rolf, Alvin E. Stein and Matthew J. Mears. The company is capitalized at $25,000 and proposes to do a general electrical business.

THE ELECTRICAL & CHEMICAL ENGINEERING COMPANY, of Los Angeles, Cal., has been incorporated with a capital stock of $10,000 by R. W. Shoemaker, W. A. Freeman and D. De Laney.

THE KILMER-RICHARDSON COMPANY, of Auburn, N. Y., has been incorporated with a capital stock of $15,000 by Joseph A. Kilmer, Thomas S. Richardson and Nelson L. Drummond, of Auburn, N. Y. The company proposes to do a general contracting and electrical business.

THE L. R. C. STORAGE BATTERY COMPANY, of Dayton, Ohio, has been incorporated with a capital stock of $30,000 by Samuel Loucks, Arthur C. Christy, Frank D. Reeder, Frank P. Brown and David L. Prugh. The company manufactures storage batteries, lighting systems for automobiles, specialties and accessories.

THE J. D. MAXWELL MOTOR CORPORATION, of New York, N. Y., has been incorporated by Jonathan D. Maxwell, of Tarrytown; James D. McManus, 361 Fiftieth Street, Brooklyn, and Leander F. Sniffen, 3411 Fort Independence Street, New York, N. Y. The company is capitalized at $10,000 and proposes to manufacture and deal in motors, etc.

THE MEAD ELECTRIC SIGNAL COMPANY, of Cleveland, Ohio, has been incorporated with a capital stock of $50,000 by T. B. Bolton, F. H. Pelton and F. W. Treadway.

THE METROPOLITAN LIGHTING COMPANY, of Baltimore, Md., has been incorporated by William E. Duncanson, of Baltimore; J. Quitman Lovell, of Garrison, Md., and Charles W. Cullen, of Georgetown, Del. The company proposes to manufacture electrical fixtures.

THE MORGAN-FUSCO COMPANY, INC., of Brooklyn, N. Y., has been incorporated with a capital stock of $3,250 by Maurice L. Fusco and Joseph Abrams, of New York, N. Y. The company proposes to manufacture and deal in gas and electric fixtures, etc.

THE MULTIPLE ELECTRIC COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $2,500 by William J. Krueger, Ralph C. Bronsen and Agnes J. Hois. The company proposes to manufacture and deal in electrical supplies.

THE NIAGARA ELECTRIC STEEL CORPORATION, of Buffalo, N. Y., has been incorporated with a capital stock of $50,000 to manufacture steel castings and alloys. The incorporators are: Leroy Lincoln, James N. Mandeville and Karl E. Wilhelm, 506 Ellicott Square, Buffalo, N. Y.

THE NORTH ELECTRIC COMPANY, of Chicago, Ill., has filed articles of incorporation with a capital stock of $2,500 for the purpose of doing a general electrical contracting business. The incorporators are: Max A. Klaus, Henry G. Elsert and E. Klaus.

THE PALTRIDGE METAL EQUIPMENT COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $50,000 by Richard W. Paltridge, Charles Denicke and Charles A. Stone. The company proposes to manufacture and deal in furniture, building equipment and electrical specialties.

THE PERKINS ELECTRIC COMPANY, LTD., of Montreal, Que., Can., has been incorporated with a capital stock of $50,000 for the purpose of dealing in electrical equipment, including lamps, switch plates and flexible conduits, etc. The officers are: George F. Perkins, president and managing director; F. J. Parsons, vice-president, and P. E. Ferguson, secretary and treasurer. The offices of the company are located at 322 Craig Street West, Montreal.

THE QUALITY ELECTRIC WORKS, of Los Angeles, Cal., has been incorporated with a capital stock of $50,000 by W. B. Palmer, S. M. Karicope and L. H. Palmer.

THE STATIC ELECTRO-ERADICATOR, INC., of Fabius, N. Y., has been incorporated with a capital stock of $25,000 for the purpose of manufacturing electrical appliances for eradication of static electricity from machinery. The incorporators are: E. L. Vesina, A. H. Smith and H. S. Palmer, of Syracuse.

THE STERLING ELECTRIC COMPANY, of Lynchburg, Va., has been granted a charter with a capital stock of $5,000 for the purpose of carrying on an electrical supply business. The officers are: A. N. Carroll, president; J. C. Oakes, secretary and treasurer.

THE THOMPSON ELECTRIC COMPANY, of Philadelphia, Pa., has given notice that it will apply for a charter for the purpose of manufacturing and dealing in electrical machinery, fixtures and apparatus; also repairing, contracting and construction work. George E. Smith, Joseph C. Thompson and Arthur H. Burton are interested in the company.

THE UNIVERSAL BATTERY COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $25,000 to manufacture and deal in electrical instruments and appliances by Louis C. Mowry, Harry L. Holton and Adolp Silberman.

THE UNIVERSAL ELECTRIC HEATER COMPANY, of Los Angeles, Cal., has been incorporated with a capital stock of $25,000 by C. O. Haskell, J. E. Adams and H. J. Wilson.

THE WESTERN AUTO-ELECTRIC CORPORATION, of Los Angeles, Cal., has been incorporated with a capital stock of $30,000 by C. S. Harper, A. J. Tobey and W. E. Carter.

THE ZIMBRICH LIGHTING COMPANY, INC., of Rochester, N. Y. has been incorporated with a capital stock of $25,000 for the purpose of manufacturing lighting fixtures, etc. The incorporators are: A. M. Zimbrich, M. Zimbrich and C. E. Bostwick, of Rochester, N. Y.

New Incorporations

PHOENIX, ARIZ.—The Clear Lake Pwr. & Irrigation Co. has been incorporated with a capital stock of $10,000,000 by R. H. Borland, F. W. Nightingale and I. Lindemann.

ASHDOWN, ARK.—The Ashdown Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by H. B. Sanderson, A. B. Du Laney, H. L. Tolland and R. B. Bryant.

HOT SPRINGS, ARK.—The Citizens' El. Co. has been incorporated with a capital stock of $500,000. The officers are S. W. Reyburn, president; Harry H. Trieber, secretary, and C. P. Perrie, treasurer, all of Little Rock.

LOS ANGELES, CAL.—The Gem Lake Pwr. & Wtr. Co. has been chartered with a capital stock of $1,000,000 by W. A. Ramsay, H. V. Henry and F. E. Edwards.

LOS ANGELES, CAL.—The Southwestern Pwr. Co. has been chartered with a capital stock of $600,000. The directors are: E. C. Richardson, C. M. Melick, E. V. Fisher, M. B. Simons, E. A. Miller, J. E. Mohi and I. N. Inskip

HARTFORD, CONN.—The Gilmore El. Co. has been incorporated with a capital stock of $50,000 by Jonathan Camp, E. D. Redfield and A. L. Shipman.

WILMINGTON, DEL.—Articles of incorporation have been filed for the El. Ser. Co. with a capital stock of $1,100,000 by H. E. Latter, W. J. Maloney and N. P. Coffin, of Wilmington.

WILMINGTON, DEL.—The Consolidated El. Utilities Corpn. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,000,000. The incorporators are: S. D. Townsend, Jr., of Wilmington; H. S. Homer, of Springfield, Mass., and J. G. Fenster, of New York, N. Y.

WARSAW, ILL.—The Tri-State Trac. Co. has been incorporated with a capital stock of $200,000 to build an interurban railway from Quincy to Hamilton. The incorporators are: J. Henry Bastert and Henry F. Dayton, Quincy; John F. Hungate and Richard O. Marsha, Warsaw, and Cornelius T. Daugherty and Earl W. Wood, Hamilton.

INDIANAPOLIS, IND.—The Indianapolis & Cincinnati El. R. R. Co. has been incorporated and is to form a part of the Indianapolis & Cincinnati Trac. Co. The new company has been formed to extend the railway from Rushville to Cincinnati, by way of Brookville, Ind., and Harrison, Ohio. The directors are: Fred D. Rose, Fred J. Oppel, L. G. Wold, L. W. Henry and William M. Frazer.

PLYMOUTH, IND.—The Plymouth El. Lt. & Pwr. Co. has been incorporated with a capital stock of $100,000 by Charles D. Virginia and Isaac Snorberger.

LOVELOCK, NEV.—The Nenzel El. Co. has been incorporated with a capital stock of $25,000 by Joseph F. Nenzel, J. T. Sullivan, J. H. Causten and J. Berger. The company proposes to build a large power plant at Oreana, which will furnish electricity in Rochester.

BUFFALO, N. Y.—The American Cataract Pwr. Co. has been incorporated with a capital stock of $1,000,000 to generate electricity. The directors are: John F. McDonald, George R. Teller, Howard A. Forman, E. L. Koons, Henry R. Hoffeld, H. A. Meldrum, Eugene L. Falk, William M. Wall and Robert F. Hefford, all of Buffalo.

MOUNT VERNON, OHIO.—The Mount Vernon Pwr. & Lt. Co. has been incorporated with a capital stock of $250,000 by H. L. Montgomery, W. R. Pomerene and George H. Booth.

SALEM, ORE.—The Interior El. Lt. & Pwr. Co. has been incorporated by Howard Evans, W. B. Brooke, W. T. Parrish, L. H. Reineman and J. A. Bradley. The company has purchased water rights on the Walla Walla River and proposes to develop about 4000 hp.

HARRISBURG, PA.—The Governor has approved the charters of the Consumers' El. Lt. Co., of Hanover Township; the Consumers' El. Lt. Co., of Nanticoke, and the Consumers' El. Lt. Co., of Newport Township, all of Luzerne County.

LEBANON, PA.—Charters have been granted to the Cornwall, Rexmont, West Cornwall and South Londerberry El. Lt., Ht. & Pwr. Cos. to operate in Lebanon County, with offices in Lebanon. Each company is capitalized at $5,000.

WINDBER, PA.—Charters have been granted by the State Department to the Fairview Lt., Ht. & Pwr. Co., of Paint Township, and the Rockingham Lt., Ht. & Pwr. Co., of Shade Township. Each company is capitalized at $5,000, and the incorporators are: J. R. Caldwell, E. A. Delaney and R. M. Mullen, of Windber.

DE LEON, TEX.—The De Leon Gorman Lt. & Pwr. Co. has been incorporated with a capital stock of $20,000 by W. E. Lowe, J. T. Collin and W. M. Tollie.

RUTLAND, VT.—The Colonial Pwr. & Ltg. Co. has been incorporated by A. Livingston Norman, of New York, N. Y.; George N. Platt and Thomas Moloney, both of Rutland. The company is capitalized at $1,000,000 and proposes to construct, acquire and operate electric, gas, steam and other power plants.

CLARKSVILLE, VA.—The Eagle Point Pwr. Co. has been incorporated with a capital stock of $50,000. The officers are: W. T. Wimbish, president; H. M. Wimbish, secretary and treasurer.

REMINGTON, VA.—The Remington Lt. & Ht. Co. has been incorporated with a capital stock of $5,000 and the following officers: J. T. Morton, president; J. R. Culp, vice-president, and W. W. Ashby, secretary and treasurer, all of Remington.

RICHMOND, VA.—The Central Arkansas Ry. & Lt. Co. has filed articles of incorporation with a capital stock of $10,500,000, maximum. The officers are: William L. McKee, of Brooklyn, N. Y., president; L. C. Gerry, of New York, treasurer, and John R. Marsh, of New York, N. Y., secretary.

SPRINGFIELD, W. VA.—The Magnolia Pwr. Co. has been incorporated by William E. Walsh, Peter J. Seaver, Cyril B. Gore and others, all of Cumberland, Md. The company is capitalized at $100,000 and proposes to construct a hydroelectric power plant on the South Branch of the Potomac River and transmit electricity to Springfield, Romney and other places in Hampshire County.

EDEN, WIS.—The Eden El. Lt. Co. has been incorporated with a capital stock of $5,000 by John O'Brien, K. L. O'Brien and Frank Sieloff.

PORT EDWARDS, WIS.—The Nekoosa Edwards Lt. & Pwr. Co. has been incorporated with a capital stock of $5,000 by L. M. Alexander, C. A. Jasperson and A. V. Marvin.

Trade Publications

RESISTORS.—Resistors for various motor-starting and speed-controlling rheostats are illustrated and described in Bulletin No. 4973 distributed by the General Electric Company.

MOTOR-GENERATOR SETS FOR RAILWAY SIGNALING.—In Bulletin No. 4085 issued by the General Electric Company battery-charging motor-generator sets for railway signaling are treated. The bulletin will interest railway men.

CONTROL SWITCH.—Bulletin A4070 of the General Electric Company illustrates and describes electrically operated remote-control switches for both alternating and direct current which are adapted for use wherever control from a central point is desired.

GASKETS.—The Goetze Gasket & Packing Company, New Brunswick, N. J., is giving publicity to its products in the form of a large poster, ready for hanging, which contains the latest price list of its gaskets and packings. Its various styles are briefly described and boldly illustrated.

CABINET SAFES FOR OFFICE AND FACTORY.—The Globe-Wernicke Company, Cincinnati and New York, has issued a catalog descriptive of its line of cabinet safes, which form an almost indispensable part of an office or manufacturing plant where records of all kinds must be filed for ready reference.

ELECTRIC FANS.—A very attractive forty-page catalog (No. 327) issued by the Sprague Electric Works of the General Electric Company is devoted to its fans, including desk and bracket, telephone-booth, oscillating and non-oscillating, universal-joint, midget exhaust and ceiling, and plain and ornamental ceiling and column fans. Brief illustrated descriptions and specifications on the various types are given.

COMPUTING CHART.—The engineering department of the National Electric Lamp Association, Cleveland, Ohio, has issued a chart designed to facilitate the solution of problems in general illumination. A description is given of a graphic method, together with a key to the computation of illumination, while various tables are prepared to show the foot-candle intensities recommended for various classes of service.

SIGN LAMPS.—An attractive publication of the General Electric Company, Bulletin A4072, is devoted to tungsten sign lamps. The bulletin contains reproductions of photographs of various styles and sizes of signs located in several cities of the United States, describes the different lamps used in connection with this method of advertising and illustrates various sign receptacles with which the lamps may be used.

METAL ROOFING AND SIDING MATERIAL.—The American Sheet & Tin Plate Company, Pittsburgh, Pa., recently issued a second edition of its popular booklet entitled "Better Buildings" Devoted, as the title denotes, to improvement in building, this booklet is interesting to those connected with building and the allied trades. It is fully illustrated and contains detailed descriptions of formed metal roofing and siding material.

SEMI-INDIRECT LIGHTING FIXTURES.—New white-glass fixtures for semi-indirect lighting are shown in a catalog issued by the Luminous Unit Company, 2615 Washington Avenue, St. Louis. The design is called the Brascolite "luminous unit" and consists of a reflecting surface of white opal glass placed above a tungsten lamp wholly or partially concealed in a bowl or ball of Alba or other glass. Various modifications of this combination are described.

SEMI-INDIRECT LIGHTING.—In a large-sized catalog bearing the imprint of the Luminous Unit Company, 2615 Washington Avenue, St. Louis, Mo., the "Brascolite" luminous unit is strikingly illustrated. With the various types shown are given brief descriptions of their design. This new reflector unit is said to be highly efficient. The last pages illustrate the method of attaching a pull switch and show the interior construction of the Brascolite luminous unit.

OXYGEN AND HYDROGEN EQUIPMENTS.—The International Oxygen Company, 115 Broadway, New York, in its pamphlet No. 9 describes its system for the separation of water into its elements, oxygen and hydrogen, by means of electricity. The generators (or cells) used, their operation, their safety and durability, and also a comparison of costs, are taken up. The I. O. C. system for the production of hydrogen is considered. Photographs of the apparatus are given, and the system as installed in two manufacturing plants is shown. Bulletin No. 10 describes the oxygen and hydrogen generators in detail and gives general and sectional views of this apparatus. These publications will interest owners, superintendents and managers of industrial establishments.

SUPERHEATERS.—"Superheating" is the title of a sixteen-page illustrated pamphlet issued by the Heine Safety Boiler Company, St. Louis, Mo. It consists of a paper reprinted from the *Journal* of the Engineers' Society of Pennsylvania, in which are discussed the steam and fuel economy of superheating, the various designs of superheaters and methods for obtaining control of the temperature of superheat. A brief description is given of the design and operation of the Heine superheater. A chart illustrates the performance of this apparatus and indicates how the steam temperature is maintained within about 5 deg. of the mean. Included in this pamphlet also are abstracts from the *Transactions* of the American Society of Mechanical Engineers on the effect of superheated steam on cast iron. These notes give examples of the effects of fluctuating steam temperatures and excessive temperatures.

Business Notes

THE HUGHES ELECTRIC HEATING COMPANY has moved its Chicago office from 226 Superior Street to 211 West Schiller Street.

THE CENTRAL TUBE COMPANY, of Pittsburgh, will occupy its new offices covering the eighteenth floor in the First National Bank Building on and after March 24.

GENERAL INSULATE COMPANY.—At the last annual meeting of the stockholders of the General Insulate & Machine Company, Brooklyn, N. Y., it was voted to change the name to the General Insulate Company. The directors have voted to increase the plant equipment by more than 50 per cent.

THE ELECTRIC UTILITIES SHOP, which is a store conducted by well-known Chicago electrical men for the sale of electrical goods to the public, will be moved about May 1 from its present quarters, 5 South Wabash Avenue, to a considerably larger place at 139 North Wabash Avenue, Chicago.

THE AMERICAN ROTARY VALVE COMPANY, which has arranged to move its Chicago office from 156 North Dearborn Street to the fifteenth floor of the new Lytton Building on the corner of South State Street and East Jackson Boulevard, is the successor of the Jenney Electric Manufacturing Company, which built a line of stationary vacuum cleaners, electric motors and printing-press equipments.

S. R. SCHAFF & COMPANY.—Mr. Schuyler R. Schaff, consulting engineer and specialist in public utilities, formerly of 5 Beekman Street, New York City, and Mr. Chester B. Starbird, electrical engineer of New York City, announce the formation of a partnership under the firm name of S. R. Schaff & Company. The office will be in the Paul Jones Building, Louisville, Ky., and the new firm's business will consist in the development, extension and operation of public utilities within operating distance of Louisville.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 4, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,054,690. ELECTRIC WIRE SUPPORTING DEVICE; H. A. Hicks, Gerty, Okla., App. filed March 7, 1912. V-shaped arm insulator.

1,054,717. FUSE; A. W. Schramm, Riverton, N. J. App. filed Nov. 29, 1911. Fuse cartridge inserted through opening in panel, with electric connections at back of panel.

1,054,766. ELECTRIC HEATING SYSTEM FOR CARS; F. Hedley, Yonkers, and J. S. Doyle, Mount Vernon, N. Y. App. filed Dec. 4, 1911. Resistance coils used at starting impart heat to interior of car.

1,054,767. ELECTRIC RAILWAY CAR-HEATING SYSTEM; F. Hedley, Yonkers, and J. S. Doyle, Mount Vernon, N. Y. App. filed Dec. 4, 1911. Heaters take current only when propelling motors are not taking current.

1,054,783. ELECTROMAGNETIC MOTOR; G. M. Mayer, Highland Park, Ill. App. filed June 5, 1911. Motor for advertising purposes, alternating current or direct current.

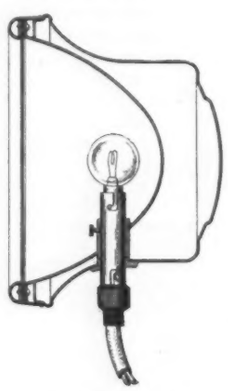
1,054,784. ELECTRIC CABLE, F. R. McBerty, New Rochelle, N. Y. App. filed Feb. 27, 1908. Flat woven multi-conductor cable with insulation omitted for short spaces at intervals to expose wires for connection.

1,054,801. SECONDARY OR STORAGE BATTERY; E. W. Smith, Philadelphia, Pa. App. filed July 21, 1910. Battery plate with active material surrounding rods and permeable tubular envelopes surrounding each rod.

1,054,809. ELECTRICAL CONNECTOR; R. H. Welles, Kenosha, Wis. App. filed June 12, 1911. Connection for electrical headlights with bayonet-slot lock.

1,054,810. ELECTRICAL CONNECTOR; R. H. Welles, Kenosha, Wis. App. filed April 17, 1912. For headlights; terminal plug locked in casing by a U-shaped spring-gripping member.

1,054,811. MEANS FOR CONTROLLING ELECTRIC APPARATUS; E. H. & K. A. Widegren, Alby, Sweden. App. filed June 8, 1910. System of transmitting writings and drawings; uses pulsating current and varies length and interval of pulsations.



1,054,809—Electrical Connector

1,054,815. TEMPERATURE REGULATING MEANS FOR CARS AND THE LIKE; W. Barstow, San Francisco, Cal. App. filed May 21, 1912. Heater and a cooler, with thermostatic control to maintain a constant temperature.

1,054,835. JAR FOR SECONDARY OR STORAGE BATTERIES; B. Ford, Philadelphia, Pa. App. filed July 19, 1911. A row of individual jars are bound together by an outer integral side wall which surrounds them all.

1,054,845. CIRCUIT-BREAKER; L. E. Hodges, Covina, Cal. App. filed Sept. 19, 1911. Thermostatically controlled; for vulcanizing purposes.

1,054,862. VARIABLE INDUCTANCE; T. E. Paling, Dundas, Ontario, Canada. App. filed Dec. 8, 1911. Current economizer for moving-picture machines.

1,054,886. METHOD AND APPARATUS FOR PRODUCING LONG ELECTRICAL ARCS; F. H. A. Wielgolaski, Christiania, Norway. App. filed May 16, 1912. Arc is lengthened or "stretched" by subjecting it to a wide, thin magnetic field.

1,054,887. AUTOMATIC TELEPHONE EXCHANGE SYSTEM; F. Wöhler, Hanover-Linden, Germany. App. filed Dec. 30, 1912. One test wire suffices to indicate "busy" condition as well as forcibly to disconnect existing connection and simultaneously connect new one.

1,054,893. HIGH-POTENTIAL ELECTRIC SWITCH; C. C. Badeau, Winthrop, Mass. App. filed Feb. 24, 1911. A series transformer has its primary leads connected to and movable with the movable switch element.

1,054,902. RESISTANCE DEVICE; L. and H. L. Bradley, Muskegon, Mich. App. filed Dec. 14, 1908. Column of graphite plates each having contact surfaces of amorphous carbon. Thirty-nine claims, some of them on process of preparing the resistant material.

1,054,909. SPARK-PLUG TESTER; A. De Clairmont, Toledo, Ohio. App. filed Oct. 3, 1911. Spaced electrodes formed with means whereby either one of them may be detachably connected with a spark plug.

1,054,917. REMOTE-CONTROL ELECTRIC SWITCH; J. R. Gunn, Detroit, Mich. App. filed March 28, 1912. Solenoid road closes circuit and a magnet draws a catch from under the rod to permit the rod to fall and break circuit.

1,054,923. SAFETY INDICATOR AND CONTROL FOR ELEVATORS; P. T. Kenny, New York, N. Y. App. filed May 26, 1909. Upon attaining dangerous speed signal is given to operator and then control is taken out of his hands.

1,054,937. VOLTAGE REGULATOR; M. Pfeffer, Vienna, Austria-Hungary. App. filed Jan. 14, 1910. Voltage regulator for each generator responds to charge of phase relation between the electromotive forces and the currents in the lines of their respective generators.

1,054,939. SNAP SWITCH; C. D. Platt, Bridgeport, Conn. App. filed Aug. 5, 1912. Down-turned lugs on a guide plate form a guide for the sliding detent, which is operated by an eccentric on the spindle-tension spring intermediate to the spindle and guide plate.

1,054,946. SELF-LOCKING LAMP SOCKET; W. A. Stacey, Chicago, Ill. App. filed May 16, 1912. Helical spring coil automatically locks lamp in socket.

1,054,965. FUSE CARTRIDGE; F. J. Ferrari, Syracuse, N. Y. App. filed May 31, 1911. Removable fuse holder within the shell permits of ready inspection and renewal of fuse.

1,054,971. BURGLAR ALARM; J. E. Liljeblad, Chicago, Ill. App. filed Oct. 22, 1909. A line or wire adjacent to the door or window causes an electrical circuit to be formed when interfered with.

1,055,003. ELECTRODE FOR PRODUCING ARCS; G. Wagener, Schlebusch-Manfort, Germany. App. filed Nov. 22, 1911. Metallic core surrounded by cement, which, when heated, becomes conductive and relieves the metal core of the wear and tear.

1,055,018. ELECTRIC GROUND DETECTOR; G. A. Burnham, Cliftondale, Mass. App. filed March 1, 1911. Indicating or recording device is intermittently placed in circuit with a group of electrical distribution lines through ground line including protective resistance.

1,055,035. ELECTRIC SWITCH; E. R. Hamilton, Chicago, Ill. App. filed Dec. 29, 1911. Lock for ignition circuit switches.

1,055,062. SOCKET FOR INCANDESCENT ELECTRIC LAMPS; L. K. Lux, Syracuse, N. Y. App. filed March 7, 1908. Reciprocating bar with exposed thumb pieces operates a cam which forces contact spring to complete circuit.

1,055,103. PROCESS OF PRODUCING SULPHONIC ACIDS OF THE NAPHTHALENE SERIES; A. Vagt, Cologne, Germany. App. filed Dec. 6, 1911. Subjects poly-sulphonic acids of the naphthalene series to action of electric current.

1,055,137. ELECTRIC-LAMP KEY SOCKET; A. W. Clauder, Bridgeport, Conn. App. filed April 19, 1912. Rotating switch piece with combination of stops for holding it.

1,055,153. SOUNDING DEVICE; D. B. Ferguson, Aurora, Minn. App. filed March 6, 1911. When device tilts over as it strikes bottom a pivoted member swings into engagement with fixed contact and closes signal circuit.

1,055,157. ELECTROLYTIC RECOVERY OF ZINC AND MANGANESE; A. G. French, Nelson, British Columbia, Canada. App. filed Sept. 4, 1912. Electrolytic decomposition of solution containing sulphate of zinc, sulphate of manganese and neutral sulphate of sodium.

1,055,158. ELECTROLYTIC RECOVERY OF ZINC AND MANGANESE; A. G. French, Nelson, British Columbia, Canada. App. filed Sept. 4, 1912. Regenerates sulphate of manganese by treating dioxide of manganese in suspension in water by sulphurous-acid gas or a sulphurous-acid solution.

1,055,160. DEVICE FOR STERILIZING CLOSET SEATS AND THE LIKE; K. Gasiorowski, Zurich, Switzerland. App. filed Nov. 25, 1912. Seat is first electrically heated and then after a time interval automatically cooled.

1,055,165. ELECTRIC BATTERY CELL; J. H. Gugler, Minneapolis, Minn. App. filed May 3, 1909. Primary cell with trough in bottom to receive loose particles of anode material and mercury in the trough.

1,055,173. CONDUIT FOR ELECTRIC WIRES; F. C. Hodkinson, Pittsburgh, Pa. App. filed Jan. 15, 1912. Made from single piece of sheet metal with hooked edges which may be interlocked.

1,055,177. ELECTRIC-LAMP SWITCH; M. J. Hoppock, Frankfort, Mich. App. filed July 10, 1912. Resistance cut into and out of circuit by turning the rotatable part of the lamp socket carrying the lamp.

1,055,185. MERCURY AND OTHER VAPOR ELECTRIC LAMP; H. A. Kent, Bound's Green, and H. G. Lacell, Finchley, England. App. filed Dec. 27, 1911. Starting device including a communicating receptacle and heating means to vaporize liquid therein.

1,055,205. TROLLEY; J. W. McKinney, Tyrone, Pa. App. filed March 25, 1912. Guide flanges attached to the harp at each side of the wheel.

1,055,221. ACCUMULATOR; J. Piotrowski and A. Kilinski, New York, N. Y. App. filed Feb. 10, 1912. Electrodes and insulating plates hung from insulating suspending bars.

1,055,227. AUTOMATIC ALARM; E. Remacle, Newark, N. Y. App. filed June 19, 1912. Fusible; for gas cocks.

1,055,236. MAGNETO-ELECTRIC MASSAGING MACHINE; B. Seacombe, Manchester, England. App. filed May 25, 1910. Movement of massaging roller generates current which is imparted to patient through said roller.

1,055,261. ELECTRIC WELDING; J. O. Ellinger, New York, N. Y. App. filed July 15, 1910. Parts are subjected to a welding current and to pressure while submerged in oil; prevents the loss of temper of the parts.

1,055,272. BULB; V. Guleserian, Buffalo, N. Y. App. filed April 6, 1912. Filament supported in pyramidal form.

1,055,275. TROLLEY WHEEL; B. H. Hawkins, Brooks, Ore. App. filed Feb. 24, 1912. Spiral rollers at opposite sides of wheel.

1,055,292. ELECTRIC-MOTOR CONTROLLER FOR ELEVATORS; J. C. Smith, Louisville, Ky. App. filed Sept. 23, 1909. Dynamic braking system.

1,055,295. ELECTRODE FOR PRODUCING ARCS; G. Wagener, Schlebusch-Manfort, Germany. App. filed Nov. 22, 1911. Metallic electrode with a surrounding body of refractory earth.

1,055,305. TEST CONNECTOR FOR ELECTRIC WIRES; A. Kneisel, Cleveland, Ohio. App. filed May 15, 1912. Angularly bent metallic clips secured together by screws.